Superfund Program

Proposed Plan – July 2021
Allied Paper, Inc./Portage Creek/Kalamazoo River Site – Operable Unit 5, Area 3
Allegan County, Michigan

1. INTRODUCTION

The purpose of this Proposed Plan is to: (1) describe the various cleanup alternatives considered for cleaning up Area 3 of Operable Unit 5 (OU5) of the Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site ("the Site"); (2) identify the U.S. Environmental Protection Agency's (EPA's) preferred cleanup alternative for Area 3 and explain the reasons for that preference; and (3) solicit public review of and comment on the remedial alternatives evaluated in this Proposed Plan and the Area 3 Feasibility Study (FS) Report.

This document is issued by EPA, the lead agency for Site activities. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) is the support agency. EPA will select a final remedy for Area 3 of OU5 after considering all comments submitted during a 30-day public comment period and providing EGLE an opportunity to review and comment on the draft decision document that describes the remedy to be selected by EPA. The public comment period runs from July 8, 2021 through August 6, 2021.

EPA encourages the public to review and comment on this Proposed Plan. EPA also encourages community members to attend and participate in a virtual public meeting on July 15, 2021. The public meeting will be held at 6:00 pm and be accessed through a link sent via EPA listserv closer to the meeting date. EPA will accept oral comments during the public meeting and written comments at any time during the public comment period.

EPA's decision on the final remedy for Area 3 of OU5 will be announced in local newspaper notices and presented in an EPA document called a Record of Decision (ROD). EPA's final cleanup decision for Area 3 could differ from the preferred alternative in this Proposed Plan depending on information or comments EPA receives during the public comment period, so it is important for the public to comment on all of the cleanup alternatives discussed in this document.

As described in more detail later in this Proposed Plan, EPA is proposing **Alternative 4** as the recommended alternative to remediate contamination in Area 3 of OU5. The proposed remediation measures focus on polychlorinated biphenyls (PCBs) as the primary contaminant of concern (COC) but also address exposure risks associated with dioxins and furans found in Area 3 of OU5. Alternative 4 includes the following major components: excavation and backfill of floodplain soil exceeding a remedial action level (RAL)[1] of 20 milligrams per kilogram (mg/kg) PCBs located outside the areas addressed by a prior time-critical removal action (TCRA); targeted excavation for media with PCB concentrations exceeding 50 mg/kg PCBs; upstream bank soil/sediment edge excavation with bank protection and restoration; transportation and off-site disposal of excavated contaminated media; Pine Creek sampling and further evaluation for

[1] A remedial action level or RAL is a value that would trigger cleanup.

monitored natural recovery (MNR); institutional controls (ICs) to advise against fish consumption; capping and/or ICs or excavation for private parcels; and long-term monitoring (LTM) and maintenance throughout Area 3. The proposed measures to remediate the contaminated sediment and soil in Area 3 of OU5 would be protective of human health and the environment, would meet applicable or relevant and appropriate requirements (ARARs), would be cost-effective, and would be effective in the long term.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Supplemental Remedial Investigation (SRI) and FS Reports and other documents contained in the Administrative Record file for Area 3 of OU5. EPA and EGLE encourage the public to review these documents to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site to date. Supporting documents for the Site are available at any of the following locations:

Kalamazoo Public Library
315 S. Rose
Kalamazoo, MI 49007
(269) 342-9837
Call for Hours

EPA Region 5 Records Center
77 W. Jackson Blvd. (SRC-7J)
Chicago, IL 60604
(312) 353-1063
Mon-Fri: 8 am to 4 pm - *Call for appointment*

Charles Ransom Library
180 South Sherwood
Plainwell, MI 49080

Allegan Public Library
331 Hubbard Street
Allegan, MI 49010

Otsego District Library
219 South Farmer Street
Otsego, MI 49078

Waldo Library
Western Michigan University
1903 West Michigan Avenue
Kalamazoo, MI 49008

2. SITE BACKGROUND

EPA listed the Site on the National Priorities List in August 1990. The Site includes former disposal areas, former paper mill properties, and contaminated sediments, banks, and floodplains of the Kalamazoo River and Portage Creek. The Site is located in both Allegan and Kalamazoo Counties of southwest Michigan (see Figure 1).

EPA often divides complex cleanup sites into smaller, more manageable sections called operable units (OUs). This Site is composed of six different OUs:

- OU1 – Allied Paper, Inc./Bryant Mill Pond;
- OU2 – Willow Boulevard/A-Site Landfill;
- OU3 – King Highway Landfill;
- OU4 – 12th Street Landfill;
- OU5 – 77 miles of the Kalamazoo River and a 3-mile stretch of Portage Creek; and
- OU7 – former Plainwell Paper Mill Property.

The 77-mile stretch of the Kalamazoo River included in OU5 runs from Morrow Dam east of Kalamazoo to the river mouth at Lake Michigan, and the included 3-mile stretch of Portage Creek is located in Kalamazoo. OU5 has been further divided into seven different areas (see Figure 2). This Proposed Plan is for Area 3 of OU5.

Area 3 of OU5 is a 3.4-mile stretch of the Kalamazoo River located between the Otsego City Dam and the former Otsego Township Dam (see Figure 3). This section of the river flows through forested wetland areas with predominantly recreational land use, although some residential parcels exist along Area 3. Area 3 includes floodplains, a portion of Pine Creek, and currently and formerly impounded areas. As shown on Figure 3, the river flows from east to west.

Site History

The Site is primarily contaminated with PCBs that were found in the waste stream at paper mills, although other industrial operations also used PCBs along the Kalamazoo River. The former paper mills recycled and/or de-inked and repulped various types of paper products including carbonless copy waste paper which, between the 1950s and 1970s, contained PCBs as an ink carrier. EPA has also identified pulp, paper and paperboard manufacturing and recycling mills as sources of dioxin and furan contamination. For many years, the mill operators disposed of contaminated wastewater by discharging it directly into the Kalamazoo River and disposed of the dewatered wastes, commonly referred to as residuals, in on-site dewatering lagoons or placed the contaminated residuals in other land or wetland areas.

The Michigan Department of Natural Resources (MDNR) first became concerned about the presence of PCBs in the Kalamazoo River in 1971, after routine surface water and biota sampling at the mouth of the river indicated that PCBs were discharging to Lake Michigan via the Kalamazoo River and that the PCBs were widely bioavailable for uptake by fish and aquatic organisms. The primary human health risks associated with the Site are from consumption of PCB-contaminated fish which have become contaminated due to erosion and runoff of PCB-contaminated soil and sediment in Portage Creek and the Kalamazoo River.

Six former hydroelectric dams are located on the river within the Site boundaries. In the 1970s, the State of Michigan partially dismantled three dams (Plainwell, Otsego, and Trowbridge). This dropped the river water level and the contaminated sediment that was once under water became exposed as PCB-contaminated floodplain soil. Lowering of the water levels also increased bank erosion.

To date, with the exception of a TCRA in Area 3 of OU5 (discussed below), remediation work along the Kalamazoo River and the adjacent OUs has included multiple PCB source control and elimination activities in upstream Area 1. These activities, which include four different TCRAs in the Kalamazoo River and/or Portage Creek as well as remedial actions at other Site OUs, have addressed the most significant known sources of PCBs to the creek and river and have helped support reductions in PCB levels in fish tissue.

In Area 3, a group of potentially responsible parties (PRPs) conducted a TCRA from 2016 to 2018 (see *Enforcement Activities* discussion below) between the M-89 Bridge and the former Otsego Township Dam. PCB-contaminated sediments and bank soils were removed, the banks were restored, and the Otsego Township Dam was removed. Detailed information about the Area 3 TCRA is provided below (see *Past Cleanup Activities in Area 3*).

The remaining contamination in Area 3 that has not yet been addressed includes contamination located in (a) floodplain soil outside the area addressed by the Area 3 TCRA, (b) Pine Creek sediment, and (c) sediment and bank soil upstream of the M-89 Bridge. Sediments and floodplain soils are the media of concern in Area 3. Groundwater is not a medium of concern at Area 3 of OU5 (see discussion below in Section 3, *Area 3 Characteristics*).

Past Investigations in Area 3

Over the years, various parties – including PRPs, EPA, and the State – collected an extensive body of data from a variety of environmental media. At OU5 (Areas 1 through 7), more than 15,000 samples had been collected and analyzed prior to the start of the OU5 SRI work in 2007. The samples were analyzed for various constituents including PCBs, metals, polycyclic aromatic hydrocarbons, and pesticides.

Sediment and soil data for Area 3 have been collected under various sampling programs, starting with the original remedial investigation (RI) work in 1993/1994. Data from the original RI were used to develop an understanding of spatial and historical PCB trends in sediment and soil in Area 3. These data were supplemented in 2000 by additional sampling. In 2011, Weyerhaeuser Company ("Weyerhaeuser") conducted additional soil and sediment sampling in Area 3. From 2012 through 2013, Georgia Pacific (GP) conducted SRI field investigations that added more than 500 PCB data points for Area 3 sediment and soil. The primary intent of the SRI work was to address localized data gaps and further define the nature and extent of contamination. In 2020, GEI Consultants on behalf of NCR Corporation ("NCR") collected additional floodplain samples, as well as sediment and fish samples from the Pine Creek Impoundment. The intent of that data collection effort was to verify results and conclusions from the SRI Report, and to help NCR determine its path forward regarding work implementation. This data correlated and confirmed the results from the SRI Report.

Past Cleanup Activities in Area 3

As noted above, a TCRA was conducted in Area 3 to address PCBs in bank soil and sediment between the M-89 Bridge and the former Otsego Township Dam. GP, International Paper Company (IP), and Weyerhaeuser conducted the work in accordance with a Unilateral Administrative Order (UAO) issued by EPA in April 2016.

The Area 3 TCRA was initiated in 2016 to address potential exposure to PCBs in sediment and eroding banks downstream of the M-89 Bridge. The TCRA was completed in August 2018, and the final post-construction monitoring and maintenance inspection was completed in August 2019. Prior to the start of the TCRA activities, the Otsego Township Dam was deteriorating and its stability was questionable. The MDNR installed a temporary water control structure (WCS) in

2015 and early 2016 to relieve stress on the dam. Removal of the temporary WCS was completed in April 2018.

The TCRA area was divided into nine bank removal and stabilization areas (BRSAs) to organize the TCRA into design and construction zones as shown on Figure 4. BRSAs were further sub-divided into grids measuring approximately 50 feet in length parallel to the river with varying widths (in general between 10 and 20 feet wide). The TCRA focused on removing, where necessary, bank soil with PCB concentrations exceeding 5 mg/kg and sediment with PCB concentrations exceeding 1 mg/kg (known here as the soil and sediment removal action levels or "RvALs"). After removal of soil and sediment, a five-point composite sample was collected within each excavation grid to confirm that the soil and sediment left in place was below the respective RvALs (5 mg/kg and 1 mg/kg, respectively). If a confirmation sample result exceeded the RvAL, excavation continued until the RvAL was reached and confirmed by additional sampling. Once excavation on a bank achieved the soil RvAL, imported backfill material and/or reused bank material with PCB concentrations less than 1 mg/kg (as required by EPA) was used to build the new stable bank and create a buffer between the river and the floodplain soil. To achieve the desired stable slope, additional excavation was sometimes required. This restoration cut and stable slope often provided a buffer exceeding the minimum required width of 10 feet.

A combination of bioengineering techniques (e.g., rootwads, joint planting) and in-stream structures (e.g., J-hook vanes) were used to restore and stabilize the banks. Bioengineering techniques incorporate standard engineering materials in combination with living native plant material. This combination of engineered and natural materials increases the strength of the bank treatment and reduces maintenance over time. Bank treatment in depositional areas involved the installation of a coir fabric, while treatments in erosional areas required a more robust treatment and included rootwads and/or joint planting. In addition to excavation and restoration, the river was restored to free-flowing conditions by removal of the temporary WCS.

The TCRA area was divided into "sediment stream tubes," and surface-weighted average concentrations (SWACs) were derived using pre-design sediment data. "Stream tubes" are stream segments oriented longitudinally in the river channel based on the general hydrodynamic flow pattern or shape of the river. Multiple parallel "tubes" provide bank-to-bank coverage of the river. The sides of the stream tubes curve to match the centerline of the river when the river curves. The ends of the tubes are perpendicular to the river flow and are determined by the location of the sampling points, typically at the midpoint between adjacent sampling points. Results from the sediment sampling and stream tube development were used to determine the sediment stream tube removals. Fifteen stream tubes were identified for removal in the TCRA area. The pre-TCRA sediment PCB SWAC downstream of the M-89 Bridge (approximately 1.65 miles) in the top 6 inches was 0.34 mg/kg. Based upon confirmation sampling in the excavated stream tubes, the estimated post-TCRA PCB SWAC in this same location and depth is 0.12 mg/kg.

A total of 34,073 cubic yards of PCB-contaminated soil and sediment was removed during the Area 3 TCRA. Five-point composite samples were collected from each excavated stream tube and BRSA to confirm RvALs were achieved. SWACs were recalculated based on post-excavation sample results. Imported backfill material and/or reused bank material with PCB

concentrations less than 1 mg/kg (as required by EPA) was used to build the new stable bank and create a buffer between the river and the floodplain soil throughout the TCRA area. Therefore, no further action is recommended in the TCRA portion of Area 3 based on the confirmation sampling results, post-TCRA sediment SWACs, and removal quantities. LTM within the TCRA area will continue to evaluate the overall effectiveness of the TCRA cleanup work.

Enforcement Activities

Enforcement activities related to Area 3 of OU5 include the following:

- In February 2007, GP and Millennium Holdings, LLC ("Millennium") entered into an Administrative Order on Consent (AOC) with EPA to conduct a series of SRIs/FSs at OU5. Following its bankruptcy in 2009, Millennium stopped participating in the SRI/FS work.
- In April 2016, EPA issued a UAO to GP, IP, and Weyerhaeuser to conduct a TCRA within Area 3. As described above, the Area 3 TCRA cleanup work was conducted between 2016 and 2018.
- In December 2019, EPA entered into a Consent Decree with NCR to conduct a TCRA within Area 4, implement the 2017 ROD for Area 2, and either implement the future ROD for Area 3 or pay EPA $52.5 million. The Consent Decree was entered in federal district court and made effective in December 2020.

In addition to enforcement activities related to Area 3 of OU5, EPA and/or EGLE have engaged PRPs to conduct work at other Site OUs, as follows:

- Millennium put in place interim remedial measures at the Allied Paper property (OU1) that effectively controlled the OU1 landfill wastes from entering Portage Creek.
- Until its bankruptcy, Millennium conducted RI/FS work at the Allied Paper property (OU1); EPA subsequently took over completion of the FS and issued a ROD for OU1 in September 2016.
- GP conducted the remedial design (RD) and remedial action (RA) work at the Willow Boulevard/A-Site Landfill (OU2) and the King Highway Landfill (OU3).
- Weyerhaeuser conducted the RD/RA work at the 12th Street Landfill (OU4) and is conducting the RD/RA work at the former Plainwell Mill (OU7).

<u>Area 3 SRI/FS</u>

As noted above, GP conducted the SRI/FS work for Area 3 of OU5 under a 2007 AOC. In accordance with the 2007 SRI/FS AOC, GP submitted many reports that it then used to support the development and evaluation of remedial alternatives for sediment and floodplain soil in the FS. The major reports are listed below and included in the Administrative Record file for Area 3 of OU5.

- Area 3 Supplemental Remedial Investigation/Feasibility Study Work Plan;

- Multi-Area FS Documents – To guide the FS process and provide consistency and efficiency across all seven areas of OU5, four Multi-Area FS Planning Documents were prepared as the first step in developing the FS reports;
- Area 3 SRI Report;
- Area 3 Alternatives Screening Technical Memorandum; and
- Area 3 FS Report.

EPA approved the Area 3 SRI Report on February 4, 2016 and the Area 3 FS Report on April 16, 2020.

Public Participation Activities

Since 2007, EPA has conducted two public meetings per year regarding cleanup activities within OU5. In addition, EPA has distributed fact sheets for each public meeting. EPA also conducted Site tours for interested stakeholders during various TCRAs conducted in Areas 1 and 3 of OU5. In March 2019, EPA facilitated the formation of the Kalamazoo River Community Advisory Group (CAG), which is comprised of individuals representing various interests throughout the community. The CAG meets monthly to share information and provide recommendations to EPA on the Site.

3. AREA 3 CHARACTERISTICS

This section of the Proposed Plan summarizes the physical characteristics and the nature and extent of contamination in Area 3 of OU5. The significant findings and conclusions from the characterization activities completed during the SRI are summarized below. Additional details are available in the Area 3 SRI Report.

Physical Characteristics

Area 3 is a 3.4-mile segment of the Kalamazoo River that lies between the Otsego City Dam and the former Otsego Township Dam, including the river floodplain, a portion of Pine Creek, and currently and formerly impounded areas. The physical characteristics of Area 3 are influenced by the dams and the confluence of Pine Creek. The Otsego City Dam is the upstream boundary of Area 3, and the location of the former Otsego Township Dam forms the downstream boundary. The upstream portion of Area 3 between the Otsego City Dam and the M-89 Bridge is approximately 1.75 miles in length, and is channelized with rock and coarser material with relatively few fine-grained sediment deposits. A few sample cores were advanced to a depth greater than 12 inches, but sediment thickness across the channel exceeded 1 foot in only one transect. Besides some locally thicker channel edge deposits, this upstream area contains much less sediment than the area downstream of the M-89 Bridge. The downstream portion of Area 3 between the M-89 Bridge and the Otsego Township Dam is approximately 1.65 miles in length and contains thicker sediment deposits, as it was an impounded area under the influence of the Otsego Township Dam prior to the removal of that dam in 2018 as part of the Area 3 TCRA. Overall, Area 3 is characterized by a narrow, channelized, upstream section that extends from the Otsego City Dam approximately 2.5 miles downstream to the confluence with Pine Creek, and a

downstream section with wider floodplain terraces and old channel areas that extend generally from the confluence with Pine Creek to the former Otsego Township Dam.

The City of Otsego is the current owner of the Otsego City Dam, which will be removed as part of the selected remedial action for Area 2. Pine Creek enters the Kalamazoo River approximately 1 mile upstream of the former Otsego Township Dam, and its elevation is regulated by the presence of a WCS that maintains the Pine Creek Impoundment. The MDNR uses the WCS to periodically raise and lower the Pine Creek Impoundment water level for the purpose of vegetation control. The WCS, which was constructed by MDNR in the 1970s, currently includes a culvert that provides a hydraulic connection between the impoundment and the Kalamazoo River. The structural height of the WCS at Pine Creek is approximately 17 feet above the Kalamazoo River. Prior to construction of the WCS in the 1970s, the interconnection of the Kalamazoo River and Pine Creek allowed river water to backflow into the lower portion of Pine Creek. That past interconnection and potential for PCBs to migrate into Pine Creek is the reason that a portion of the Pine Creek Impoundment is included in Area 3.

The Otsego Township Dam was constructed in 1903 to generate hydroelectric power for the town of Otsego. The dam was destroyed in 1903 by a large flood and was rebuilt in 1904. In 1970 MDNR took over ownership of the Otsego Township Dam, and the spillway gates were opened to lower the upstream impoundment. The Otsego Township Dam was further dismantled and lowered through the mid-1980s. The drawdown and dismantling of the dam lowered water levels by approximately 10 feet. Due to continued deterioration of the Otsego Township Dam, MDNR constructed a WCS adjacent to the Otsego Township Dam in 2016 to return the Kalamazoo River to its original channel. The WCS was removed during the Area 3 TCRA and the former Otsego Township Dam was rubblized and the area restored.

Physically, Area 3 is distinctly different from upstream Area 2 in that it lacks braided channels or large floodplain areas. Land use within this segment of river varies, with commercial and residential use upstream near the Otsego City Dam and less-inhabited wooded areas downstream on State-owned MDNR lands. The river bottom is predominantly sand and gravel with some fine-grained sediment. Fine-grained sediment occurs in areas along the channel margins, the former impounded area at Pine Creek, and the TCRA area upstream of the Ostego Impoundment Dam. As described above, the stream bed upstream of the M-89 Bridge is primarily sand, rock, and gravel with very few sediment deposits except in some areas of fines along the banks. The average water depth in Area 3 of the Kalamazoo River ranges from 2 to 8 feet.

Nature and Extent of Contamination

This section explains why groundwater is not a medium of concern in Area 3 and summarizes the nature and extent of contamination in the sediment and floodplain soil within Area 3 of OU5. All PCB concentrations are reported as total Aroclors (total PCBs).

Groundwater not a Medium of Concern

As part of the Plainwell Impoundment TCRA in upstream Area 1, five quarterly[2] groundwater sampling events were conducted in a network of 15 monitoring wells between 2008 and 2009. PCBs were not detected in groundwater. Based on that groundwater monitoring, in conjunction with groundwater monitoring data from other Site source OUs showing similar non-detect PCB results, knowledge of the nature of the PCB contamination at the Site, and similar hydraulic characteristics of Area 3 with upstream areas, EPA has concluded that groundwater is not a medium of concern at Area 3 of OU5.

Sediment and Floodplain Soil Sampling Summary

As discussed above, from 1993 to 2013 there were significant sampling efforts site-wide. The SRI for Area 3 of OU5 focused on data gaps and further defining the nature and extent of contamination. More than 600 sediment samples were collected and analyzed for PCB Aroclors, with a subset analyzed for total organic carbon (TOC) and grain size. In addition, a subset of samples was analyzed for inorganics, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans (dioxins/furans). Sediment PCB concentrations ranged from non-detect (ND) to 156 mg/kg. The non-PCB constituents are discussed below in Section 5, *Summary of Site Risks*.

More than 1,100 soil samples were collected from riverbanks and floodplains throughout Area 3 and analyzed for PCB Aroclors, with a subset analyzed for TOC, grain size and percent solids. In addition, a subset of samples was analyzed for inorganics, VOCs, SVOCs, pesticides, and dioxins/furans. Soil PCB concentrations ranged from ND to 120 mg/kg.

Distribution of PCBs in Sediment

Sediments are defined as materials collected in areas with flowing or standing water. The spatial distribution of PCBs in Area 3 is significantly influenced by historical changes in water level elevations associated with the former Otsego Township Dam and geomorphology. Generally, PCBs tend to be found at elevated concentrations in the lower-elevation geomorphic features. These features were inundated when the former Otsego Township Dam was operated at its full height, where water velocities are slower, and where deposition of fine sediment is more likely to occur. Higher concentrations of PCBs in the upstream portion of Area 3 may also be found in river-edge sediment where PCB-containing floodplain bank soils erode and deposit along the river channel edges. There are two stream tubes located along the banks in the upstream portion of Area 3 which had PCB concentrations above 1 mg/kg. Overall, Area 3 sediment samples collected closer to the banks tended to have higher PCB concentrations than samples collected from the center of the river channel.

Detailed discussions of the PCB concentrations in sediment are included in the Area 3 SRI Report.

[2] Quarterly sampling means sampling was conducted four times per year, roughly every 3 months.

Surface-Weighted Average Concentration of PCBs in Sediment

A SWAC is a method of spatially calculating the mean (average) concentration of a constituent in the sediment surface. Samples are collected throughout the area of concern, representative subareas are generated for each sample location, and a subarea-weighted average concentration is calculated to produce the SWAC.

Sediment SWACs were calculated for the upstream subarea and downstream subarea (in relation to the M-89 Bridge) of Area 3 for six sediment depth intervals: 0 to 6 inches, 6 to 12 inches, 12 to 24 inches, 24 to 36 inches, 36 to 48 inches, and greater than 48 inches. (Note: upstream of the M-89 Bridge, insufficient sample locations were available for the 36- to 48-inch and greater than 48-inch intervals.)

The Area 3 SWACs are less than the sediment SWAC preliminary remediation goal (PRG)[3] of 0.33 mg/kg except in the surface interval (0 to 6 inches) upstream of the M-89 Bridge, which has a SWAC of 0.36 mg/kg. The downstream subarea SWAC was 0.34 mg/kg prior to the Area 3 TCRA and is 0.12 mg/kg post-TCRA, based upon TCRA confirmation samples within stream tubes. The Pine Creek SWAC from the surface interval (0–6 inches) had a mean of 0.3 mg/kg and a 95% upper confidence limit (UCL) of 0.4 mg/kg, which is statistically within the range of the sediment PRG of 0.33 mg/kg.

Distribution of PCBs in Floodplain Soil

Soils are defined as materials collected in areas without standing water. Along the riverbank, soils represent the area above the water line under normal flow conditions. The factor with the most influence over the distribution of PCBs in Area 3 floodplain soils was the operation of the former Otsego Township Dam and the resulting impacts on the impoundment. Historic higher water elevations and occasional flood events dispersed PCB-containing sediments over the (now exposed) wide floodplains that flank the river in the downstream subarea. The entrenched and incised upstream subarea was not significantly affected by the former Otsego Township Dam Impoundment in terms of flood events and higher water elevations.

Samples collected closer to the banks in Area 3 generally had higher PCB concentrations than samples collected from other floodplain locations, and subsurface bank samples generally had the highest PCB concentrations. In the downstream subarea, the highest PCB concentrations were found in the top 2 feet of soil. However, some individual locations in deeper sample intervals exhibited PCB concentrations that exceeded 50 mg/kg. PCBs were generally found at elevated concentrations in the lower-elevation geomorphic features. These features were inundated when the former Otsego Township Dam was operated at its full height, but are now exposed as floodplain following the lowering and ultimate removal of the dam.

Detailed discussions of the PCB concentrations in floodplain soils are included in the Area 3 SRI Report.

[3] PRGs are discussed in more detail in Section 6 of this Proposed Plan. PRGs are used, in part, to define the extent of contaminated media requiring remedial action.

PCBs in Residential Soil

Sampling in residential areas bordering the Kalamazoo River in Area 3 occurred in 2000 and 2013. Average PCB concentrations in residential soils are below relevant health-based standards and are not expected to cause an unacceptable risk to residents. During the 2013 sampling event, an incremental sampling method was used to investigate residential backyards. The backyard soil samples were collected from 0 to 12 inches deep. PCB concentrations from these samples were below 0.3 mg/kg. The residential PRG, based on a site-specific risk evaluation, is 2.5 mg/kg.

Conceptual Site Model

A conceptual site model (CSM) was developed for Area 3 of OU5 based on Site characteristics and results from the SRI investigations. The CSM tells the story of how and where the PCB contamination moved and what impacts such movement may have had upon human health and the environment.

As described in the CSM, PCBs are the primary COC. Site data shows that exposure to PCBs will drive risks at the Site, and that the management of risks due to PCB exposure will also address risks associated with other non-PCB constituents. PCB levels in fish are linked to concentrations in sediment and surface water through the food chain. Risks to humans and aquatic ecological receptors are driven by the consumption of PCB-contaminated fish. Human health risk estimates show concentrations of PCBs in fish tissue result in exceedances of EPA target levels for both cancer and non-cancer risks; this will be further discussed in Section 5, *Summary of Site Risks*.

The primary mechanism of PCB exposure is uptake through the food chain via PCB-contaminated sediment that already exists in the river and that continues to enter the river by erosion of PCB-contaminated bank material. External sources of PCBs to Area 3 as well as background sources of PCBs from areas upstream of Area 1 (which have mean PCB background sediment concentrations of 0.31 mg/kg) are expected to sustain low levels of PCBs in fish tissue in the long term, even with control of known potential source areas associated with historical papermaking operations.

The primary sources of PCBs to Area 3 are previously-suspended fine particles that have settled primarily into the formerly impounded regions of Area 3 during historical periods of recycling of paper products that contained PCBs. In Area 3 upstream of the M-89 Bridge, soils and sediments containing PCBs are unevenly distributed at varying depths, depending on the location (i.e., whether on the insides or outsides of bends in the river). Because of the upstream Otsego City Dam and source control actions in Area 1 and associated OUs, ongoing sediment sources into Area 3 are expected to be limited to suspended sediments from upstream of the Otsego City Dam, eroding bank soils, nonpoint sources, and atmospheric deposition. There are no known, ongoing point sources of PCBs in Area 3.

The media of concern in Area 3 are sediments and floodplain soils. PCB-contaminated sediments and bank soils both can lead to PCB uptake in fish. The targeted remediation areas in Area 3 are

the floodplains outside of the Area 3 TCRA, Pine Creek sediment, and the sediment and bank soil upstream of the M-89 Bridge.

Principal Threat Wastes

The principal threat concept is applied to the characterization of "source material" at a Superfund site. Source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contaminants to groundwater, surface water or air, or acts as a source for direct exposure. EPA has defined principal threat wastes as those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

EPA has not identified any principal threat wastes at OU5 of the Site. The PCB-contaminated soil and sediment throughout OU5 are reworked and re-deposited materials that have been mixed with water, soil and sediment throughout Area 3. The concentrations of PCBs at OU5 are considered to be low-level threat wastes.

4. SCOPE AND ROLE OF THE ACTION

As described earlier, the Site has been broken into a number of separate OUs. In keeping with EPA's policies regarding the management of contaminated sediment sites, EPA's approach has been to control the significant potential sources of PCBs to the river first, before addressing the contamination in the river (OU5). A number of response actions have been taken at other Site OUs that effectively control releases from those OUs to OU5. The remediation of OU5 no longer depends on the sequencing of work at any of the other OUs.

OU5 of the Site has been broken into seven different areas, with Area 1 being the furthest upstream and Area 7 being the furthest downstream. While SRI/FS work is being conducted concurrently in several of the OU5 areas, EPA intends to make final cleanup decisions and conduct final cleanup actions in the river in one area at a time, from upstream to downstream.

The current status of upstream Areas 1 and 2 is as follows:

- EPA signed a ROD for Area 1 in September 2015. The Area 1 RD/RA is being implemented by GP, IP, and Weyerhaeuser pursuant to a UAO issued by EPA in December 2016.
- EPA signed a ROD for Area 2 in September 2017. The Area 2 RD/RA work will be implemented by NCR pursuant to a December 2019 consent decree, which was entered in federal district court and made effective in December 2020.

As discussed in Section 2, *Site Background*, a TCRA was conducted from 2016 to 2018 within the downstream portion of Area 3 between the M-89 Bridge and the former Otsego Township Dam. A total of 34,073 cubic yards of PCB-contaminated soil and sediment was removed during the TCRA. No further action is recommended in the TCRA portion of Area 3 based on the confirmation sampling results, post-TCRA sediment SWACs, and removal quantities. LTM within the TCRA area will continue to evaluate the overall effectiveness of the TCRA cleanup

work. The proposed remedial action in this Proposed Plan will address the remaining PCB-contaminated sediment and soil in Area 3 and is intended to be the final response action for Area 3. It does not address the other OUs at the Site nor other areas (Areas 1, 2, 4, 5, 6, 7) within OU5.

5. SUMMARY OF SITE RISKS

This section summarizes the risks to human health and the environment that are posed by the contamination.

Contaminants of Concern

As described in the generalized CSM, PCBs are the primary COCs. The available data indicate that exposure to PCBs will drive risks at the Site, and that management of risks due to PCB exposure will also address risks associated with other non-PCB constituents.

During the investigation of Areas 1, 2, and 3 of OU5, samples collected from various media and biota in and along Portage Creek and the Kalamazoo River, including soil, sediment, surface water, and fish tissue, were selectively analyzed for non-PCB constituents. Samples were analyzed for metals, VOCs, SVOCs, pesticides, and dioxins/furans. Many non-PCB constituents were detected in all media, likely from multiple point and non-point sources in the industrialized portions of the watershed (and general anthropogenic deposition throughout the watershed), and may not be directly linked to the PCB releases.

On April 2, 2015, EPA approved the *Area-Wide Non-PCB Constituent Screening Evaluation*. Sediment and soil samples were collected in Areas 1, 2, and 3 and analyzed for non-PCB constituents, and the sample results were pooled to produce a statistically relevant data set for this evaluation. The purpose of the evaluation was to determine which non-PCB constituents in soil and sediment, based on a consideration of background concentrations and human health and ecological screening values, presented a risk to human health and the environment. The evaluation demonstrated that total PCBs will drive risk management and remedial decisions for sediment and soil in Area 3.

In addition, dioxin-like PCBs and dioxin/furans were further addressed through a collocation mapping exercise in the *Technical Memorandum - Collocation Mapping of PCB Dioxin-Like Compound TEQs, Dioxins/Furans, and Total PCBs*, which was submitted on April 16, 2015 to EPA and EGLE (known at the time as the Michigan Department of Environmental Quality (MDEQ)). The collocation mapping showed that concentrations of dioxin-like PCBs and dioxins/furans would be included in the PCB remediation footprint. As a result, EPA believes that risk management and remedial decisions based on total PCBs will address dioxin-like PCBs and dioxins/furans. However, in the event that dioxins/furans are found in floodplain surface soils in current or potential residential-use areas outside the PCB remediation footprint, a separate PRG for dioxins/furans has been established, as discussed in more detail in Section 6 of this Proposed Plan.

Baseline Human Health Risk Assessment

The baseline human health risk assessment (BHHRA) for the Site was completed by MDEQ's contractor, CDM, in 2003 as part of the original RI. The BHHRA evaluated potential current and future risks to people who may live or engage in recreational activities near the Kalamazoo River and its floodplains along all seven areas of OU5, including risks to subsistence and sport anglers who may consume fish caught from the Kalamazoo River. Additionally, the Michigan Department of Community Health (MDCH) prepared a Health Consultation for the Site in 2002.

GP's former contractor, ARCADIS, updated the BHHRA in 2012 as part of the Area 1 SRI to reflect the results of additional fish tissue samples collected since the publication of the 2003 BHHRA. The updated BHHRA provided updated risk and hazard estimates for subsistence and sport anglers associated with exposures to PCBs released into the Kalamazoo River system. GP's current contractor, Amec Foster Wheeler, further updated the BHHRA in 2016 based upon additional data collected as follows: in 2011 from Area 3 of the river; in 2012 from Morrow Lake; and in 2013 from residential properties bordering the river in Area 3.

In addition to fish consumption by anglers, several other potential exposure pathways were described in the 2003 BHHRA that are relevant to Area 3, as follows:

- *Consumption of turtles:* Although this pathway was evaluated qualitatively as a potential exposure pathway, the BHHRA concluded that the overall exposure and risks to receptors ingesting turtles would be less than that of anglers. The analytical data that exist for turtle tissue indicate that PCB concentrations are less than that for smallmouth bass and carp fish tissue.
- *Consumption of waterfowl*: This exposure pathway was considered in the BHHRA. However, because of data limitations with waterfowl samples, CDM did not complete a qualitative evaluation or quantify risk estimates for this exposure pathway.
- *Direct contact with river sediment (by swimmers or waders):* Direct contact exposures to river sediment during recreational activities (swimming, wading) were determined not to be important means of exposure to PCBs, based on the Health Consultation prepared by the MDCH. As a result, such exposures were not evaluated further in the BHHRA.
- *Exposure to in-stream surface water (by swimmers or waders):* Due to the relatively low ingestion rates of surface water, the low solubility of PCBs in water, and the low dermal absorption of PCBs, the BHHRA concluded that this pathway could be assumed to be without risk.
- *Exposure to air:* Inhalation of particulates and volatile emissions from exposed floodplain soil and sediment were quantitatively evaluated in the BHHRA, but inhalation of volatile emissions from surface water was not quantitatively evaluated.
- *Direct contact with floodplain soil and exposed sediment:* Residential developments exist adjacent to the floodplains in Area 3. The BHHRA evaluated direct contact pathways (dermal contact and incidental ingestion) that may be relevant to residents (the most highly-exposed receptor group) or recreational visitors.
    - *New information since the 2003 BHHRA*: At the recommendation of EPA, 20 incremental soil samples were collected in 2013 at nine residential properties

along the river in Area 3. The results are discussed in *BHHRA Conclusions*, below.

Fish Advisory

In 2014, the Michigan fish advisory was replaced by the *Eat Safe Fish Guides* issued by the Michigan Department of Health and Human Services (MDHHS) for different regions of the state. The *Eat Safe Fish Guides* and other important resources are available at michigan.gov/eatsafefish.

The 2018 MDHHS *Eat Safe Fish Guide* for Southwest Michigan recommends no consumption of any species of fish from the Kalamazoo River upstream of the Allegan Dam (at the downstream end of Area 6) to the Morrow Dam in Kalamazoo County (at the upstream end of Area 1). The Kalamazoo River within Area 3 is located within this "do not eat" advisory area. The 2018 *Eat Safe Fish Guide* allows for limited consumption of certain species of fish from the Pine Creek Impoundment (within Area 3) and from the portion of Portage Creek included within OU5 (within Area 1).

In the Pine Creek Impoundment in Area 3, three fish species (bluegill, carp, and sunfish) have advisories specific to PCBs and two fish species (largemouth bass and smallmouth bass) have advisories specific to mercury. Bluegill and sunfish of any size are both limited to four servings[4] per month for each, and carp of any size are limited to one serving per month. Consumption of largemouth bass and smallmouth bass under 17 inches is limited to two servings per month for each type of fish, and consumption of largemouth bass and smallmouth bass over 17 inches is limited to one serving per month for each type of fish.

In Portage Creek, specifically downstream of the Monarch Mill Dam and including the Bryant Mill Pond, consumption of carp (any size) is limited to one or two times each year, but only for people over 15 years old who are healthy, not planning on having children in the next several years, and not currently pregnant or breastfeeding. Anyone not meeting these criteria (i.e., people under the age of 15, people who have health problems, or people who are planning on having children in the next several years or who are currently pregnant or breastfeeding) are advised to not eat any carp. Consumption of suckers (any size) is limited to 6 servings per year. Consumption of all other species is advised as "do not eat."

The MDHHS fish consumption advisories are only recommendations, are not legally binding, and have limited effectiveness in protecting human anglers from Kalamazoo and Allegan Counties. A survey from 1994 showed that anglers ate on average two meals per month of various species taken from contaminated reaches of the river, including bass, catfish, panfish, bullheads, and carp. More than 10 percent of the anglers surveyed ate more than one meal per week of these various species. This survey confirmed that the Kalamazoo River is an important recreational resource and may serve as an important source of food for certain human subpopulations.

[4] Serving sizes are defined in the *Eat Safe Fish Guide* and depend on a person's weight.

BHHRA Conclusions

The likelihood of any kind of cancer resulting from exposure to carcinogens at a Superfund site is generally expressed as an upper bound incremental probability, such as a "1 in 10,000 chance" (expressed as 1×10^{-4}). In other words, for every 10,000 people exposed to the site contaminants under reasonable maximum exposure conditions, one extra cancer may occur as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risk of cancer individuals face from other causes such as smoking or too much sun. The risk of cancer from such other causes has been estimated to be as high as one in three. The potential for non-cancer health effects is evaluated by comparing an exposure level over a specified time period (such as a lifetime) with a "reference dose" derived for a similar exposure period. A reference dose represents a level that is not expected to cause any harmful effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ < 1 indicates that the dose from an individual contaminant is less than the reference dose, so non-cancer health effects are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs that affect the same target organ (such as the liver). An HI < 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, non-cancer health effects from all contaminants are unlikely. An HI > 1 indicates that site-related exposures may present a risk to human health. EPA's acceptable risk range is defined as a cancer risk range of 1×10^{-6} to 1×10^{-4} and an HI < 1. Generally, remedial action at a site is warranted if cancer risks exceed 1×10^{-4} and/or if non-cancer hazards exceed an HI of 1.

The BHHRA for the Site (including Area 3) presented estimated cancer risks and non-cancer hazards for several populations of anglers consuming fish from the Kalamazoo River and for residential and recreational receptors exposed to floodplain soil adjacent to the former Plainwell, Otsego, and Trowbridge Impoundments.

Risk characterization for anglers was performed for three potential populations: central tendency sport anglers, high-end sport anglers, and subsistence anglers.[5] Two exposure scenarios for the three angler populations were included in the BHHRA: the first assumed a diet of 100 percent pelagic (non-bottom feeding) fish species and the second assumed a mixed species diet (76 percent pelagic species and 24 percent bottom-feeding species).

The updated BHHRA for Area 3 showed that potential excess cancer risks and non-cancer hazards exceeded acceptable levels for the fish ingestion pathway for all three angler populations. Cancer risks and non-cancer hazards were highest for the subsistence angler (4×10^{-4} and an HI of 25, respectively). Cancer risks and non-cancer hazards were lowest for the central tendency sport angler (6×10^{-5} and an HI of 3, respectively). Adverse health effects associated with PCB exposure include increased risk of liver cancers and reproductive and immunological impairment.

The 2003 BHHRA estimated that the risks from the fish ingestion pathway were approximately 60 to 70 times greater than the risk estimates for floodplain soil pathways for residents and recreational receptors. The 2003 BHHRA evaluated the floodplain areas around the former

[5] Central tendency sport anglers were estimated to consume an average of 0.015 kg fish tissue/day (24 half-pound meals/year). High-end sport anglers were estimated to consume 0.078 kg fish tissue/day (125 half-pound meals/year). Subsistence anglers were estimated to consume 0.11 kg fish tissue/day (179 half-pound meals/year).

Plainwell and Plainwell 2 impoundments, the Otsego Dam, and the Trowbridge Dam. Estimated risks for residents exposed to average floodplain surface soil concentrations were within EPA's acceptable risk range but were greater than EGLE's cancer risk threshold of 1×10^{-5}. Excess cancer risk estimates exceeded the acceptable risk range when the maximum detected concentration for each area was used.

For residential receptors exposed to floodplain soil via multiple routes (i.e., ingestion, dermal contact, and inhalation of fugitive dust), HIs for the reproductive endpoint exceeded 1 for all three areas when maximum concentrations were used, but were less than 1 using average floodplain soil concentrations. HIs for immunological endpoints exceeded 1 for all three areas using both average and maximum floodplain soil concentrations.

Excess cancer risks and non-cancer hazards for recreationists exposed to average floodplain surface soil concentrations were within EPA's acceptable risk range and less than EGLE's cancer risk threshold of 1×10^{-5} in all three areas evaluated. When the maximum floodplain soil concentration was used, potential cancer risks were within EPA's acceptable risk range but were greater than EGLE's cancer risk threshold. HIs were greater than 1 when maximum soil concentrations were used.

The updated BHHRA for Area 3 quantitatively evaluated direct contact pathways (dermal contact and incidental ingestion) that may be relevant to residents (the most highly-exposed receptor group) or recreational visitors. At the recommendation of EPA, 20 incremental soil samples were collected in 2013 at nine residential properties bordering the river in Area 3. PCB concentrations in the surface soil (0-6 inches) in yards ranged from ND to 0.134 mg/kg. PCB concentrations in subsurface soil (6-12 inches) in yards ranged from ND to 0.213 mg/kg. These residential sampling results are well below the residential PRG of 2.5 mg/kg.

As noted earlier, fish advisories are currently in place in an effort to address risks to humans from consumption of fish. There are currently no restrictions in place to control human exposures to sediment, soil, or surface water.

In summary, the fish ingestion pathway poses unacceptable risks and hazards to anglers. Additionally, potential exposure to maximum floodplain soil concentrations may pose unacceptable risks and hazards to residents and recreationists. The BHHRAs made assumptions using best professional judgment and available scientific literature on risk assessments.

Baseline Ecological Risk Assessment

As part of the original RI, CDM prepared a baseline ecological risk assessment (BERA) for OU5 that identified terrestrial and aquatic receptors and exposure pathways. During the Area 1 SRI, an updated terrestrial BERA (TBERA), covering terrestrial birds and mammals, was conducted. The methods and approaches incorporated in the Area 1 TBERA built on the information in the BERA and the CSM. The TBERA also accounted for updated risk assessment guidance and scientific research, additional sampling results, a December 2008 peer review panel report, two completed TCRAs in Area 1, and source control activities completed or underway at the former mill properties and landfill OUs in Area 1 since the BERA was completed. The Area 1 TBERA

did not revisit the aquatic portion of the BERA but carried forward those associated conclusions. As part of the Area 3 SRI, the TBERA was updated to incorporate recent Area 3 data.

Summary of OU5 BERA

The BERA was conducted to evaluate potential adverse effects to terrestrial and aquatic ecological receptors associated with PCB exposures in surface water, sediment, surface soil, and biota. Representative ecological receptors included aquatic plants, aquatic macroinvertebrates, game fish, forage fish, rough fish, terrestrial invertebrates, small burrowing omnivorous mammals, semi-aquatic herbivorous mammals, small semi-aquatic carnivorous mammals, and top mammalian and avian predators. The BERA evaluated complete exposure pathways that included the following:

- Surface water – direct contact, uptake, ingestion, or ingestion of prey
- In-stream sediment/interstitial water – direct contact, ingestion, or ingestion of prey
- Surface soil/floodplain sediment and soil – direct contact, ingestion, or ingestion of vegetation/prey

The BERA concluded the following:

- Most aquatic biota, such as invertebrates and fish, are not expected to be adversely affected by direct contact with and ingestion of surface water because of relatively low PCB toxicity to most aquatic biota.
- PCB contamination of surface water and streambed sediment may adversely affect sensitive piscivorous predators, such as mink, through the consumption of PCB-contaminated fish.
- Terrestrial and semi-aquatic biota are potentially at risk from floodplain sediment and surface soil, depending on life cycle characteristics (e.g., foraging behavior, diet, mobility) and predicted sensitivity to PCBs.

Summary of Area 3 TBERA

The updated Area 3 TBERA built upon the prior OU5 BERA and the Area 1 TBERA. The updated Area 3 TBERA for terrestrial birds and mammals is included as Appendix K of the Area 3 SRI Report. The methods, inputs, and approaches incorporated in the updated Area 3 TBERA are the same as those employed in the Area 1 TBERA. The updated Area 3 TBERA incorporates current Agency guidance, current science, and new data collected to support the SRI activities. Representative receptors were selected as the most highly-exposed species likely to inhabit Area 3. The representative receptors included insectivorous birds (house wren), vermivorous mammals (short-tailed shrew), vermivorous birds (American robin and American woodcock), carnivorous mammals (red fox), and carnivorous birds (red-tailed hawk).

The Area 3 TBERA conclusions are summarized as follows:

- Overall, the Area 3 TBERA found a potential risk to moderate- or low-sensitivity insectivorous (e.g., house wren) and vermivorous (e.g., American robin, American woodcock) birds in Area 3.

- Possible risk was identified for high-sensitivity insectivorous (e.g., gray catbird, European starling) and vermivorous birds, if present. (Note: no highly-exposed, high-sensitivity vermivorous birds have been observed at the Site in over 30 years of surveys conducted by the Kalamazoo River Nature Center. High-sensitivity birds may not be present, in part, due to the presence of PCB contamination.)
- Risk to vermivorous mammals (e.g., short-tailed shrew) is possible, but limited in areal extent.

Because there is potential risk to ecological receptors exposed to PCB-contaminated floodplain soils, remedial alternatives to protect ecological receptors were developed and evaluated in the FS and are discussed in this Proposed Plan.

Basis for Taking Action

It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

6. REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are goals for protecting human health and the environment. RAOs are developed to address the contaminant levels and exposure pathways that present unacceptable current or potential future risks to human health and the environment. The development of RAOs and proposed cleanup levels, known as preliminary remediation goals or PRGs, is the first step in identifying and screening remedial alternatives for addressing the COCs and media of concern.

Remedial Action Objectives for Area 3

The following five RAOs have been developed for PCB-containing media and biota in Area 3:

- **RAO 1: Protect people who consume Area 3 Kalamazoo River fish from exposure to PCBs that exceed protective levels.** This RAO is expected to be progressively achieved over time by meeting the following targets for fish tissue and sediment:
    - Reduction in fish tissue to the Michigan fish advisory level for smallmouth bass to two meals per month (0.11 mg/kg total PCB concentration) within 30 years[6].
    - Achievement of a non-cancer HI of 1 and a 10^{-5} cancer risk within 30 years for the high-end sport angler (100 percent bass diet; 125 meals/year)[7].
    - The above fish tissue goals for bass will be achieved by protecting fish from exposure to sediment PCB SWACs above 0.33 mg/kg in Area 3 following completion of the remedial action.

[6] This specific target is a goal of the remedial action, but it is not a PRG.

[7] The non-cancer and cancer risk levels described here are what drive the PRGs for RAO 1.

- **RAO 2: Protect aquatic ecological receptors from exposure to concentrations of PCBs in sediment that exceed protective levels for local populations.** This RAO is designed to protect fish-eating birds and mammals by reducing fish tissue PCB concentrations to levels that do not harm the sustainability of local populations of these receptors[8].
- **RAO 3: Protect terrestrial ecological receptors from exposure to concentrations of PCBs in soil that exceed protective levels.** This RAO is intended to protect local populations of birds and mammals by reducing PCB concentrations in soil to levels that do not harm the sustainability of local populations of these receptors.
- **RAO 4: Reduce transport of PCBs from Area 3 to downstream areas of the Kalamazoo River and Lake Michigan.** This RAO includes reducing the potential for erosion and downstream migration of PCB-impacted sediment and riverbank soil.
- **RAO 5: Protect people that reside in Area 3 from exposure to COCs that exceed protective levels.** This RAO is intended to protect local residents from exposure to COC concentrations that may cause a carcinogenic risk greater than 10^{-5} or an HI greater than 1.

Preliminary Remediation Goals

PRGs are risk-based or ARAR-based chemical-specific concentrations that help further define the RAOs. PRGs are considered "preliminary" remediation goals until a remedy is selected in a ROD. The ROD establishes the final remedial goals and/or cleanup levels. PRGs are also used to define the extent of contaminated media requiring remedial action, and are the targets for the analysis and selection of long-term remedial goals.

The BHHRA developed a series of risk-based concentrations (RBCs) for total PCBs in fish, sediment, and floodplain soil intended to be protective of anglers, recreationists, and residents, while the BERA and TBERA developed RBCs for sediment and floodplain soil intended to be protective of sensitive wildlife receptors. The RBCs are calculated, chemical-specific concentrations below which no significant health effects are anticipated for a receptor. For human receptors, Area 3 RBCs correspond to a target risk for carcinogenic effects of 1×10^{-5} and a target HI of 1 for non-carcinogenic effects. For ecological receptors, RBCs correspond to a target HQ of 1. RBCs for ecological receptors represent a risk range based on "No Observed Adverse Effects Level" and "Lowest Observed Adverse Effects Level" risk estimates for each receptor group.

<u>Selection of Fish Tissue Preliminary Remediation Goals</u>

The selection of a fish tissue PRG for total PCBs was a multi-step process that considered the RBC_{fish} values generated for each receptor, the likely exposure scenario to be frequently encountered, and the background levels of PCBs in fish tissue. Although a subsistence angler scenario was included in the calculation of RBC_{fish}, this pathway represents a worst-case scenario that is not expected to be frequently encountered compared to sport anglers. The RBC_{fish} would likely reflect a diet that is weighted toward the 100 percent smallmouth bass consumption

[8] See the PRG table on page 23.

scenario (over a mixed carp and bass species scenario) because the smallmouth bass is a popular sport fish on the Kalamazoo River. The range of RBC_{fish} for sport anglers is from 0.042 mg/kg to 0.187 mg/kg (non-lipid corrected). The upper end of this range is similar to the mean background concentration in smallmouth bass fillets in Morrow Lake immediately upstream of Area 1 (0.23 mg/kg). Another background reference area further upstream of Area 1 (Ceresco) had mean smallmouth bass fillet concentrations of 0.03 mg/kg. The upper end of this range is also protective of women of childbearing age and young children consuming one half-pound meal a month from the site.

For RAO 1, the recommended fish tissue PRGs for total PCBs are 0.042 mg/kg for carcinogenic effects (based on a risk of 1×10^{-5}) and 0.072 mg/kg for non-carcinogenic effects (based on an HI of 1). These PRGs are based on risk estimates to sport anglers and sensitive populations, and take into account background considerations[9].

For RAO 2, the recommended fish tissue PRG for total PCBs is 0.6 mg/kg, which is protective of mink (the most sensitive ecological receptor).

Selection of Sediment PRGs

The selection of a sediment PRG for total PCBs considered the human health RBC_{sed} values associated with the human receptors who consume fish. EGLE conducted an independent evaluation and has recommended a sediment PRG of 0.33 mg/kg. EGLE concluded that this PRG value is appropriate for sediment because it is sufficiently protective of the high-end sport angler. This PRG value also corresponds to EGLE's historical PCB detection limit that has previously been used as a sediment screening and target level in Michigan under Michigan's Natural Resources and Environmental Protection Act, Part 201. Based upon the aforementioned information and discussions between EPA and EGLE, a PRG of 0.33 mg/kg was selected. Further, this PRG is close to the mean background sediment concentration of 0.31 mg/kg.

A sediment PRG of 0.33 mg/kg for total PCBs is protective of both human and ecological receptors. In Area 3, the SWAC is applied in the TCRA area (i.e., downstream of the M-89 Bridge) (1.65 miles) and in the upstream area from the M-89 Bridge to the Ostego City Dam (1.75 miles) (see Figure 3). Sediment concentrations below 0.33 mg/kg are not likely to bioaccumulate in fish tissue to levels that present unacceptable risks and hazards to human populations, and will promote the achievement of the fish tissue RAOs over time.

Selection of Floodplain Surface Soil PRGs

The selection of a floodplain surface soil PRG for total PCBs was based on the range of site-specific RBC_{soil} values calculated for human recreationists and ecological receptors, with the ecological RBC_{soil} values driving the selection of the PRG because they were much lower than the values for human receptors. Although ecological risk was predominantly associated with high-sensitivity insectivorous and vermivorous birds and vermivorous mammals in the Area 3 TBERA, a range of RBC_{soil} was calculated based on the protection of multiple wildlife receptors. The uncertainty associated with the TBERA RBCs is summarized in the Area 3 FS Report.

[9] The high-end sport angler is assumed to consume 125 meals/year.

A floodplain soil PRG of 11 mg/kg for total PCBs is based on protectiveness of 1-acre home ranges for maximum exposed mammals, and is consistent with those developed for Area 1 and Area 2. Based on the analysis presented in the Area 3 FS Report, a PRG of 11 mg/kg is expected be protective of 99.2% of the possible 1-acre home ranges for maximally exposed mammalian receptors (i.e., the shrew). A PRG of 11 mg/kg PCBs is also assumed to be protective of avian receptors as it represents a balance between risk and uncertainty associated with the various methodologies and assumptions used in the TBERA to calculate risk to avian receptors. Therefore, the proposed PRG of 11 mg/kg in floodplain soil is protective of the various ecological receptors.

For floodplain surface soil in current or potential residential use areas, a PRG of 2.5 mg/kg for total PCBs is recommended to protect residential receptors. Human recreational receptors would be protected by use of a floodplain soil PRG of 23 mg/kg for total PCBs. However, since the ecological PRG (11 mg/kg) is more stringent than the PRG for human recreational receptors (23 mg/kg), the 11 mg/kg PRG for floodplain soil will serve to protect both ecological receptors and human recreational receptors.

For the bank soil areas upstream of the M-89 Bridge, a PCB RAL of 5 mg/kg is being applied to target bank soil areas requiring excavation and bank restoration. Although additional remedial design sampling is required, remediation of these banks will most likely also encompass the two stream tubes with sediments greater than 1 mg/kg. As a result, the proposed bank remediation also ensures that the adjacent sediments will achieve the 0.33 mg/kg sediment PRG, since the current sediment SWAC upstream of the M-89 Bridge is already close to the PRG. Once bank excavation to the RAL is achieved, imported backfill material and/or reused bank material with PCB concentrations less than 1 mg/kg (as required by EPA) will be used to build the new stable bank and create a buffer between the river and the floodplain soil. To achieve the desired stable slope and restoration, additional excavation may be required in order to provide a minimum buffer width of 10 feet.

As discussed in the *Contaminants of Concern* discussion in Section 5 above, EPA believes that risk management and remedial decisions based on total PCBs will address dioxin-like PCBs and dioxins/furans. However, in the event that dioxins/furans are found in floodplain surface soils in current or potential residential-use areas outside the PCB remediation footprint, a separate PRG for dioxins/furans has been established. To protect residential receptors, EPA proposes a PRG of 50 parts per trillion (ppt), reported as total toxic equivalents (TEQ) which includes both dioxins/furans and dioxin-like congeners, based on current EPA Regional Screening Levels (RSLs) for residential land use.[10] Confirmation sampling would be used to measure the levels of PCBs and dioxin/furans in any residential areas being actively remediated to ensure that remaining soil does not present a significant risk to human health or the environment should exposure occur. For parcels with non-residential land use, EPA proposes a PRG of 990 ppt TEQ consistent with EGLE Part 201 soil cleanup criteria. Further, residential properties that encroach

[10] EGLE offered Part 201 soil cleanup criteria for dioxins/furans as an ARAR. EPA evaluated the potential ARAR and concluded that the Part 201 soil cleanup criteria for dioxins/furans are not an ARAR for residential properties because EPA's dioxin/furan residential RSL, which is proposed as a PRG, is more stringent than the values promulgated by state regulations. Although there is currently no data indicating contamination that would trigger cleanup based on the State's cleanup criteria for dioxin/furans on non-residential properties, EPA considers Part 201 an ARAR for non-residential properties.

on State-owned property would include a buffer zone, consistent with Michigan Compiled Laws 324.20101(ii), and the 50 ppt TEQ residential PRG would apply within the buffer zone.

Summary of PRGs

The table below summarizes the various PRGs that are proposed for Area 3. The ability to meet the various risk-based fish tissue PRGs will be evaluated during the five-year review process following the Area 3 remedial action. These reviews will consider factors identified during LTM that may limit overall fish tissue and sediment recovery (e.g., fish tissue or sediment concentrations approaching background levels, which include atmospheric deposition and/or other non-site sources of PCBs to the river system).

The risk-based PRG levels for PCB remediation in soil meet the risk-based disposal requirements for PCBs set by EPA's Toxic Substance Control Act (TSCA) regulations. As explained in footnote 10, EPA also evaluated ARARs for establishing the dioxin/furan PRG for floodplain soils. EPA concluded that the State soil cleanup regulations are considered ARARs for non-residential properties but are not considered ARARs for residential properties, since the residential risk-based PRG established by application of EPA's RSL for dioxins/furans is more stringent than the state's promulgated value.

Recommended PRGs for Area 3 of OU5	
Media/Biota	**PRGs for Total PCBs**
Fish Tissue	0.042 mg/kg (RAO 1, cancer risk of 1 x 10^{-5}); 0.072 mg/kg (RAO 1, non-cancer HI of 1); 0.6 mg/kg (RAO 2, ecological receptors)
Sediment	0.33 mg/kg (SWAC in each river section)
Floodplain Soil	23 mg/kg – recreational receptors; 11 mg/kg – ecological receptors (applies to all areas except residential since the ecological PRG is lower than the recreational PRG); 2.5 mg/kg – residential areas
Media	**PRGs for Dioxin/Furan TEQ (if needed)**
Floodplain Soil	50 ppt – residential areas; 990 ppt – non-residential areas

Remediation Areas

For purposes of developing potential remedial alternatives, the FS identified the various sediment and floodplain areas that would require remediation based on the RAOs and PRGs specific to Area 3 of OU5.

The Area 3 TCRA conducted from 2016-2018 addressed sediment and bank soil/channel edges downstream of the M-89 Bridge within the boundaries of Area 3. As discussed earlier (see discussion of *Past Cleanup Activities in Area 3* within Section 2, *Site Background*), no further

action is recommended within the Area 3 TCRA footprint, based on post-excavation confirmation sampling results which show that the post-TCRA sediment SWAC in the TCRA footprint is below the sediment PRG, and the fact that river bank soil concentrations are below the floodplain soil PRGs and are subject to ongoing LTM and maintenance. Areas of proposed active remediation outside the Area 3 TCRA boundary, if included in the selected remedial alternative, would be designed to tie-in to the completed Area 3 TCRA restoration areas with minimal impact. The design elements may include appropriate slopes and grading, and replanting of vegetation consistent with the Area 3 TCRA restoration area. Surface features like feeder streams would be considered during remedial design to maintain the surface water drainage considered during the TCRA.

The PCB SWAC analysis was used as a screening tool to evaluate the distribution of PCBs in sediment and to identify sediment remediation locations in Area 3. The SWACs provide predictions of the average exposure concentration in a specified area. As noted earlier, the post-TCRA SWAC downstream of the M-89 Bridge was 0.12 mg/kg PCBs, which is below the sediment PRG of 0.33 mg/kg. The sediment SWAC upstream of the M-89 Bridge is 0.36 mg/kg, only slightly above the sediment PRG of 0.33 mg/kg. The SWAC for the Pine Creek Impoundment has a mean of 0.3 mg/kg and a 95% UCL of 0.4 mg/kg, which is statistically within the range of the sediment PRG of 0.33 mg/kg.

EPA evaluated remedial alternatives for floodplain soil at locations that exceed ecological or human exposure PRGs, and for bank soil that could contribute PCBs via erosion to downstream areas. These areas include floodplain areas outside the footprint of the Area 3 TCRA downstream of the M-89 Bridge, and bank soil/edge sediment upstream of the M-89 Bridge and contiguous floodplain soil.

Addressing PCBs in bank soil/edge sediment will reduce PCBs in fish tissue over time. Concentrations of PCBs in surface water will also go down after the bank soil/edge sediment contributions of PCB-contaminated material to surface water are eliminated.

Remedial Areas for Evaluation

The remedial footprints selected for the comparative evaluation of remedial alternatives were based on the data collected during the SRI and the Area 3 TCRA design. These remedial footprints represent approximate areas for comparative evaluation of remedial alternatives and were based on PCB concentrations greater than 50 mg/kg, maximum PCB concentrations at any depth, and the 0- to 24-inch median composite PCB concentration interpolations maps for floodplain soils. This generated an initial floodplain remedial footprint of 16.5 acres. To address concerns that a low bias may exist for the results of samples analyzed by the laboratory during the SRI, PCB interpolation maps for floodplain soils were also generated using mean values to ensure the remedial footprint would be adequately captured and would reflect the “bounds” of uncertainty. This generated an upper bound on the floodplain remedial footprint of 31 acres. Additional floodplain data collected in 2020 by GEI Consultants on behalf of NCR confirmed that the estimates for floodplain remediation are similar to those defined by the initial median interpolations of 16.5 acres. The actual remedial footprint to be addressed by the remedy selected in the ROD will be defined during the RD based on additional sampling.

A RAL of 20 mg/kg ("RAL-20") was selected for determination of the floodplain remediation footprint, after an initial evaluation based on potential PCB RALs of 15, 20 and 25 mg/kg. The RALs were applied to both median and mean interpolation maps, and included pre- and post-TCRA data simulations to help bound uncertainty on home-range protectiveness as well as evaluate the RAL application. No significant difference in home-range protectiveness was observed using different methodologies, and the RAL-20 was deemed appropriate for use in Area 3. The use of RAL-20 is also consistent with the remedies selected for upstream Areas 1 and 2 of OU5. A practical remedial footprint was developed for remedial alternative development by smoothing, joining, or enlarging the boundaries of modeled footprints. This resulted in a 1.6-acre increase in the floodplain remediation footprint, from the initial 16.5-acre modeled RAL-20 footprint. The smoothed RAL-20 footprint is 18.1 acres.

A moving-window analysis was repeated with the revised footprint to evaluate the effect of smoothing on home-range protectiveness. The minimum RAL-20 home-range protectiveness achieved after smoothing was 99.2% for the ecological receptors protected at the PRG of 11 mg/kg.

The remedial areas downstream of the M-89 Bridge, which are depicted in Figure 5 (denoted in the legend as "FS Area") include the floodplains outside the Area 3 TCRA footprint and portions of the Pine Creek Impoundment. The bank and sediment bed remedial areas upstream of the M-89 Bridge include banks with PCB concentrations greater than the RAL of 5 mg/kg and adjacent instream sediment. These areas are depicted on Figure 6, with different colored lines denoting the expected degree of remedial design sampling as described below under "Common Elements" in Section 7. Remediating and stabilizing these areas will achieve RAO 4 (to reduce downstream PCB transport) and will lower the sediment SWAC to below the target sediment PRG. In turn, the reductions in aquatic PCB exposures are anticipated to reduce fish tissue PCB concentrations and achieve RAO 2 and the corresponding fish tissue PRGs over time. Additional sediment remediation beyond what is described above is not necessary because PRGs are anticipated to be achieved and the majority of elevated exposures are in the sediment bed adjacent to PCB-impacted banks.

7. SUMMARY OF REMEDIAL ALTERNATIVES

A range of alternatives was developed for soil and sediment to achieve the Area 3 RAOs. Remedial alternatives were developed by assembling combinations of appropriate remedial technologies. The Area 3 remedial alternatives are described below and summarized on Table 1. Additional details about all the remedial alternatives are available in the Area 3 FS Report.

EPA is recommending and proposing Alternative 4 as the remedy for Area 3 of OU5.

Common Elements

Five remedial alternatives were evaluated in the Area 3 FS report. Components that are common to Alternatives 2 through 4 are presented here as a group in order to limit redundancy in the

subsequent discussion of the individual alternatives. The common components of Alternatives 2 through 4 are:

- No further action in the TCRA areas.
- Identification and confirmation of the remedial area footprints through additional sampling during the RD.
- Excavation of media exceeding 50 mg/kg PCBs.
- Focused bank/edge sediment removal and bank restoration upstream of the M-89 Bridge, with bank protection and restoration engineering controls (ECs). The potential bank treatment and removal areas upstream of the M-89 Bridge are divided into three categories as shown on Figure 6. These categories include:
    - Few to no samples and low PCB concentrations: These locations highlighted in black on Figure 6 are not substantial depositional areas and generally tend to be characterized by high bank bluffs. Where samples are available, they tend to have PCB concentrations well below 5 mg/kg. Samples will be collected during remedial design to confirm that remediation is not required.
    - Few samples with higher PCB concentrations or no samples: This area, highlighted in blue on Figure 6, has a narrow floodplain along the toe of a steep bluff. The few samples collected here indicate discrete PCB sample concentrations ranging from less than 0.33 mg/kg to 23 mg/kg. Remedial design sampling is needed to confirm the extent of banks/sediment edges requiring remediation. For cost-estimating purposes, it is assumed that 15% of this area will be subject to remediation to address RAO 4. Remedial action, where required, assumes excavation, bank toe stabilization, and bank restoration. Banks that are remediated would be protected from further erosion with bank treatments that are inclusive of a 10-foot buffer as an added safety factor, as was done downstream of the M-89 Bridge during the Area 3 TCRA.
    - Remedial focus area (bank/sediment edge hot spots): These areas are highlighted in pink on Figure 6. PCB concentrations within this reach typically range from 5 mg/kg to 50 mg/kg, with bank conditions like those in the downstream TCRA areas. Bank soil/sediment edge remediation for these areas is included in the remedial alternatives to address RAO 4. The extent of bank/edge removal zones will be confirmed with remedial design sampling. Remedial action assumes excavation, bank toe stabilization, and bank restoration. Banks would be protected from further erosion with bank treatments that are inclusive of a 10-foot buffer as an added safety factor, as was done downstream of the M-89 Bridge during the Area 3 TCRA.

  This area includes approximately 11,300 cubic yards (cy) of bank soil/edge sediment excavation along 6,600 feet of the Area 3 channel upstream of the M-89 bridge. The full extent of the area requiring remediation will be delineated during remedial design. Customary and standard ECs would be included in upstream bank designs to ensure that restored banks would be compatible with shear stress associated with the removal of the Otsego City Dam. These would include robust bank treatments (e.g., wrapped earth with live stakes, buried rip rap/boulders, rootwads, and other vegetative cover), in-stream

energy dissipation structures to reduce shear stress along the bank, and optimization of the channel depth/width, as appropriate and practical. Upstream bank restoration activities would also consider the development concepts from the Otsego City Master Plan.

- Monitored natural recovery for the Pine Creek Impoundment. The rationale for including MNR for Pine Creek as a common element in several of the remedial alternatives is as follows:
    - MNR for Pine Creek sediment was included in several of the remedial alternatives based on fish tissue concentrations in the Pine Creek Impoundment. A fish tissue PRG of 0.042 mg/kg has been developed to protect receptors who consume fish. In 2012, fish tissue samples were collected for both largemouth bass and carp. Fish tissue concentrations for largemouth bass were less than the fish tissue PRGs for fish ingestion from this area. For carp, tissue concentrations either met or approached the fish tissue PRG based on samples collected. In August 2020, 40 fish tissue samples were collected for PCB analysis from fish species including bluegill, carp, largemouth bass, and pumpkinseed. PCB concentrations in fillets of adult bluegill, largemouth bass, and pumpkinseed were less than the fish tissue PRG. Adult carp were the only fish species that exceeded the PRG with PCB concentrations ranging from 0.046 to 0.36 mg/kg. Both the largemouth bass and carp tissue concentrations are less than the tissue concentrations from the upstream reference locations at Morrow Lake and Ceresco.
    - Sediment sampling was performed in the impoundment during a summer drawdown in 2013, and well-established vegetation was observed in the mudflats. However, not enough samples were collected to adequately estimate a sediment SWAC. The samples showed that Pine Creek surface sediment (the 0-6" interval) is generally cleaner than the underlying material. In five of the seven Pine Creek sediment cores, the surface interval PCB concentration was less than half of the sediment PRG. The remaining two cores had PCB concentrations above the sediment PRG. In June 2020, 92 sediment samples from 25 cores were taken from Pine Creek. The data confirmed that surface sediments were cleaner than deeper sediments. The SWAC for the surface interval (0–6 inches) had a mean of 0.3 mg/kg and a 95% UCL of 0.4 mg/kg, which is statistically within the range of the sediment PRG of 0.33 mg/kg. (Both spatial interpolations and subsequent arithmetic averages and ULC95s, and the aspatial arithmetic average and UCL95, yielded similar results.) The sediment data collected in 2020 provided consistent results with previous data, supporting MNR.
    - Continuation of MNR as a remedy would include the collection of sediment and fish tissue samples during LTM to (1) evaluate MNR conditions in the Pine Creek Impoundment relative to meeting the sediment PRG of 0.33 mg/kg and (2) demonstrate that the fish tissue concentrations have not increased to concentrations above the PRGs.
- An LTM program and maintenance of ICs and ECs until long-term goals are achieved. The LTM program would confirm the ongoing effects of natural processes and document the continued declines in PCB concentrations in various media, resulting in reductions in

risk and ecological exposures. It is anticipated that the monitoring program would be designed to supplement the current program that includes fish and water column monitoring. The final components of the LTM program would be defined during the RD.

The LTM program would be implemented to monitor, confirm, and document the decline of PCB concentrations in Site media in Area 3 following remedy implementation, and document MNR in Pine Creek. The LTM program would include inspection and maintenance of bank treatments and riparian restoration completed under both the remedial action and the Area 3 TCRA, inspection and maintenance of capped floodplain areas (if any), and verification that the ICs implemented as part of the remedy remain in place. Fish tissue and sediment sampling would be performed to (1) confirm that sediment concentrations throughout Area 3 have attained the sediment PRG of 0.33 mg/kg; (2) evaluate MNR conditions in the Pine Creek Impoundment relative to meeting the sediment PRG of 0.33 mg/kg over time; and (3) document that fish tissue concentrations have attained PRGs or are decreasing. Additional remediation would be considered if remedial design data do not support MNR in Pine Creek. The LTM sampling program would support post-remedy five-year reviews and would include collection of sediment, soil, surface water, and fish tissue samples. The LTM program would continue until all PRGs are achieved and EPA approves the discontinuation of LTM in Area 3.

For cost-estimating purposes, it was assumed that the LTM program would include the following activities:

- Fish monitoring twice every 5 years during the LTM period. Fish samples would be collected in Area 3. The actual sampling location(s) would be specified during the RD. Smallmouth bass and carp would be collected at each sampling location. Adult carp and both adult (fillet) and young-of-year (whole-body) smallmouth bass would be collected and analyzed for total PCBs and lipid content. The projected time for fish recovery is estimated to be 33 years and the cost estimates assume that LTM continues until year 39 to allow two to three fish collection events beyond the projected recovery time.
- Surface water quality monitoring annually for the first five years, then once every five years for the remainder of the LTM period to support EPA's periodic five-year reviews. Surface water samples would be analyzed for total PCBs.
- Sediment samples would also be collected to support EPA's five-year reviews by monitoring ongoing recovery conditions and natural attenuation processes throughout Area 3.
- Visual inspections of riverbank erosion along all Area 3 banks within the TCRA area and areas upstream of the M-89 Bridge where bank stabilization and restoration occur. The visual inspections would be conducted annually for the first five years, then once every five years for the remainder of the LTM period. Additional inspections would be conducted after major storm/flooding events, as necessary. Any necessary maintenance would need to be conducted.
- Inspection and surveying of banks following high flow (i.e., 2-year, 5-year, 10-year, 25-year, 50-year, 100-year) events so that conditions leading to a failure or a

full-scale failure can be identified, located, and repaired and to ensure that banks withstand various flow conditions.

  - Maintenance of banks ahead of full-scale failure if data suggests that sections of banks are eroding or unstable, to prevent the erosion of PCB-contaminated floodplain soils from behind the buffer into the river.
  - Fish tissue and sediment sampling once every 10 years in the Pine Creek Impoundment as part of MNR.
  - Verification of ICs would include verifying the status of the ICs and replacing controls (i.e., warning signs along the river) every 5 years until fish tissue concentrations reach acceptable levels.

- ICs in the form of site-specific fish consumption advisories established and publicized by the State of Michigan would continue to manage risks posed to anglers and their families from consumption of PCB-containing fish.[11] These advisories, which include warning signage posted along the river, are already in place for Area 3, and the advisory for each fish type would remain in effect until fish tissue PCB concentrations achieve RAOs for the fish specified. The advisories would be reviewed and verified annually as a component of the Site ICs.
- In addition to fish consumption advisories, other ICs would be implemented, as necessary, and maintained in Area 3 of OU5, as follows:
  - ICs would be required for any floodplain areas that are capped, to prevent disturbance of the caps and ensure the integrity of the constructed remedy components.
  - Land use restrictions to prevent future residential use and limit human exposure to recreational-use-only scenarios may be implemented where concentrations greater than 2.5 mg/kg PCBs are found in floodplain soil during RD sampling, unless this material is excavated from the private parcel(s) to achieve the residential soil PRG, pending agreement by owners. Another option would be to cap floodplain soils found to exceed 2.5 mg/kg PCBs, pending agreement by owners, and to implement land use restrictions to prevent future residential use, limit human exposure to recreational-use-only, and prevent disturbance of the cap(s). In addition to the private parcels in Area 3, there are industrial-zoned and recreational parcels for which ICs may be required.
- Use of a proposed RAL for PCBs of 20 mg/kg for floodplain soil (i.e., floodplain soils exceeding 20 mg/kg PCBs would trigger action and be addressed as part of the floodplain remediation footprint). The RAL-20 value is based on an assessment of the following factors: the incremental risk reduction that would be achieved; the desire to protect 95% to 100% of the receptors (i.e., shrew, wren, and robin); and the incremental area and soil volume associated with each potential RAL value. The use of RAL-20 would achieve the proposed PRG of 11 mg/kg PCBs in floodplain soil and therefore would, at a minimum, be protective of 99.2% of ecological receptor home ranges.

[11] The fish consumption advisories issued by MDHHS are only a recommendation, are not legally binding, and have limited effectiveness in protecting human health. Fish advisories, alone, would not be an appropriate remedial alternative.

Remedial Alternatives

Alternative 1: No Action

Regulations governing the Superfund program require that the "no action" alternative be evaluated generally to establish a baseline for comparison. As described in Section 2 of this Proposed Plan, a TCRA has already been conducted in Area 3 of OU5. The No Action remedial alternative, Alternative 1, would require no additional action in Area 3. Under Alternative 1, natural recovery processes would likely continue to occur in the river as a result of completed and ongoing remedial actions in Area 1 and other upstream OUs, but such processes would not be monitored or documented. Ongoing natural recovery processes include deposition of cleaner sediment from the watershed and mixing of surface and cleaner sediment. No active remediation or monitoring would be conducted under this alternative. Alternative 1 would not address RAOs 3, 4, or 5, as it would not address contaminated floodplain soils and would not reduce the transport of PCBs from Area 3 to downstream areas of the Kalamazoo River and Lake Michigan. The time to reach protective levels in the sediment and compliance with PRGs is estimated to be a minimum of 34 years, but no LTM program would be conducted to document progress toward achievement of PRGs.

Estimated Capital Cost: $0
Estimated Annual Operation and Maintenance (O&M) Cost: $0
Estimated Total Present Worth Cost: $0
Estimated Construction Timeframe: None

Alternative 2: Capping of floodplain soil exceeding RAL-20 outside of TCRA areas, targeted excavation, upstream bank soil/sediment edge excavation with bank protection and restoration ECs, Pine Creek MNR, ICs, capping and/or ICs or excavation for private recreational parcels, and LTM

The components of Alternative 2 are discussed in detail below and shown on Figure 7. In summary, Alternative 2 includes:

- No further action in the completed TCRA areas;
- RD sampling as approved by EPA;
- Capping of floodplain soil exceeding RAL-20 outside of TCRA areas;
- Targeted media excavation exceeding 50 mg/kg PCBs;
- Upstream bank soil/sediment edge excavation, with bank protection and restoration ECs (as discussed above in the *Common Elements* section);
- Transportation of excavated contaminated media to appropriate, approved landfills for off-site disposal;
- Pine Creek MNR (as discussed above in the *Common Elements* section);
- ICs to advise against fish consumption;

- ICs for capped areas in the floodplain (as discussed above in the *Common Elements* section);
- Capping and/or ICs or excavation for private recreational parcels with floodplain soil exceeding 2.5 mg/kg PCBs (as discussed above in the *Common Elements* section); and
- LTM and maintenance including area-wide monitoring, inspection, and maintenance of bank erosion controls and capped areas (as discussed above in the *Common Elements* section).

Capping would be completed in floodplain areas outside the TCRA footprint where soil PCB concentrations exceed the proposed RAL of 20 mg/kg to prevent exposure to ecological receptors at a PRG of 11 mg/kg in the moving window evaluation. Using a RAL of 20 mg/kg as a trigger for action and meeting a PRG of 11 mg/kg would also be protective of recreational users, who would be protected by a PRG of 23 mg/kg. Confirmed TSCA media exceeding 50 mg/kg would be excavated and backfilled prior to capping. A two-foot thick soil cap (ecological exposure zone) would be installed over a geotextile placed on the existing (prepared) ground surface to serve as a demarcation layer, if needed. The need for geotextile would be evaluated during remedial design and would depend upon underlying PCB concentrations.

Bank soil and edge sediment excavation would be performed upstream of the M-89 Bridge as described above in the *Common Elements* section. The anticipated remedial footprint is subject to remedial design sampling. Remedial action assumes excavation, bank toe stabilization, and bank restoration. ECs would include elements such as robust bank treatments (e.g., wrapped earth with live stakes, buried rip rap/boulders, rootwads, and other vegetative cover), in-stream energy dissipation structures to reduce shear stress along the bank, and optimization of the channel depth/width. Where removal of soil along the bank face occurs, the cross-sectional length of removal would include the 10-foot buffer and would also depend on the bank treatment and design requirements for the restored bank slope. These treatments typically range in length from 3 to 7 feet and would be included within a 10-foot buffer provided as an additional safety factor. Banks opposite to those undergoing remedial excavation would be protected from excessive erosion during construction if the channel width is narrowed to accommodate construction activities. Transitions in bank treatment between bank areas that require remediation and those that do not require remediation are included in the conceptual design and costing.

Alternative 2 includes approximately 18.1 acres of capping downstream of the M-89 Bridge plus 11,300 cy of bank soil/edge sediment excavation along 6,600 feet of the Area 3 channel upstream of the M-89 Bridge. The total remedial footprint comprises approximately 22.1 acres.

MNR for Pine Creek sediment is supported by fish tissue concentrations and risk calculations completed for fish ingestion in the Pine Creek Impoundment as described above in the *Common Elements* section. Risk associated with fish ingestion from this area is within an acceptable range for central tendency and high-end sport anglers, and is slightly above the acceptable range for subsistence anglers. The 2012 fish tissue sample results from Pine Creek indicated that all the largemouth bass fillet samples collected were ND for PCBs at a detection limit of 0.04 mg/kg and met the PRG for fish tissue of 0.042 mg/kg. PCB concentrations in carp fillet tissue ranged from 0.022 to 0.29 mg/kg. In August 2020, 40 fish tissue samples were collected for PCB

analysis from fish species including bluegill, carp, largemouth bass, and pumpkinseed. PCB concentrations in fillets of adult bluegill, largemouth bass, and pumpkinseed were less than the fish tissue PRG. Adult carp were the only fish species that exceeded the PRG with PCB concentrations ranging from 0.046 to 0.36 mg/kg. Both the largemouth bass and carp tissue concentrations are less than the tissue concentrations from the upstream reference locations at Morrow Lake and Ceresco. In addition, the majority of the cores in Pine Creek indicate that the top 6 inches of the sediment typically contain less than 0.33 mg/kg of PCBs. In June 2020, 92 sediment samples from 25 cores were taken from Pine Creek. The data confirmed that surface sediments were cleaner than deeper sediments. The SWAC from the surface interval (0–6 inches) had a mean of 0.3 mg/kg and a 95% UCL of 0.4 mg/kg, which is within the range of the sediment PRG of 0.33 mg/kg. (Both spatial interpolations and subsequent arithmetic averages and ULC95s, and the aspatial arithmetic average and UCL95, yielded similar results.) MNR for Pine Creek requires additional sediment and fish tissue sampling to confirm sediment and fish tissue PRGs have been attained or are decreasing. Should future data indicate sediment and fish are above PRGs, additional remedial action may be required.

In addition to fish consumption advisories, ICs would be needed for any floodplain areas that are capped, to prevent disturbance of the caps and ensure the integrity of the constructed remedy components. Other ICs may also be needed, including land use covenants to prevent future residential use where concentrations greater than 2.5 mg/kg PCBs are found to exist on private parcels. Two privately-owned parcels that are currently used recreationally were identified in the floodplain downstream of the M-89 Bridge. Depending on RD sampling results, these properties may be candidates for excavation, capping, and/or a deed restriction providing for recreational-use-only future use scenarios, as described in the *Common Elements* section above. Several parcels upstream of the M-89 Bridge were sampled using an incremental sampling method; sample results were less than 2.5 mg/kg and do not indicate an unacceptable risk at residential parcels.

An overall LTM program would be implemented to monitor, confirm, and document the decline of PCB concentrations in Site media in Area 3 following remedy implementation, and to document MNR in Pine Creek. The LTM program would include inspection of bank treatments and riparian restoration completed under the remedial action and TCRA and verify the maintenance ICs implemented as part of the remedy. Fish tissue and sediment sampling would be performed to evaluate MNR conditions in the Pine Creek Impoundment relative to meeting the sediment PRG of 0.33 mg/kg over time and to document that fish tissue concentrations are not increasing to unacceptable concentrations. The LTM sampling program would support post-remedy five-year reviews and would include collection of sediment, soil, surface water, and fish tissue samples. Should remedial design and LTM indicate that fish tissue concentrations are increasing and exceed fish tissue PRGs, then an active remedy and remedial footprint for Pine Creek Impoundment within the study boundary would be evaluated.

The time to reach protective levels and compliance with PRGs under Alternative 2 is estimated to be a minimum of 33 years after ROD issuance.

Estimated Capital Cost: $25,900,000
Estimated Annual O&M Cost: $87,200

Estimated Total Present Worth Cost: $26,300,000
Estimated Construction Timeframe: 2 years

Alternative 3: Combination of capping and excavation of floodplain soil exceeding RAL-20 outside of TCRA areas, targeted excavation, upstream bank soil/sediment edge excavation with bank protection and restoration ECs, Pine Creek MNR, ICs, capping and/or ICs or excavation for private recreational parcels, and LTM

Alternative 3 is the same as Alternative 2, except the floodplain soil containing PCBs greater than a RAL of 20 mg/kg within 50 feet of the channel would be excavated with the remainder being capped. The components of Alternative 3 are discussed in detail below and shown on Figure 8. In summary, Alternative 3 includes:

- No further action in the completed TCRA areas;
- RD sampling as approved by EPA;
- Combination of capping and excavation of floodplain soil exceeding RAL-20 outside of TCRA areas;
- Targeted media excavation exceeding 50 mg/kg PCBs;
- Upstream bank soil/sediment edge excavation, with bank protection and restoration ECs (as discussed above in the *Common Elements* section);
- Transportation of excavated contaminated media to appropriate, approved landfills for off-site disposal;
- Pine Creek MNR (as discussed above in the *Common Elements* section);
- ICs to advise against fish consumption;
- ICs for capped areas in the floodplain (as discussed above in the *Common Elements* section);
- Capping and/or ICs or excavation for private recreational parcels with floodplain soil exceeding 2.5 mg/kg PCBs (as discussed above in the *Common Elements* section); and
- LTM and maintenance including area-wide monitoring, inspection, and maintenance of bank erosion controls and capped areas (as discussed above in the *Common Elements* section).

Excavation would be targeted for the portions of the remediation footprint within 50 feet of the channel to provide benching and additional floodplain connectivity and capacity (Figure 8). The floodplain areas considered for capping versus excavation were selected using results of the hydrodynamic model as detailed in the Area 3 FS. The model results indicate that removal of soil where the RAL-20 footprint is within 50 feet of the river and capping in the remainder of the RAL-20 footprint would not diminish the capacity of the floodplain to accommodate floods. Disturbed areas (capped or excavated) would be restored as riparian habitat, and remediated banks would be restored with erosion control ECs.

Caps would be constructed of a permeable geotextile, if needed, overlain with 1.5 feet of common fill and 6 inches of topsoil, and vegetated. The need for geotextile would be evaluated during remedial design and would depend upon underlying PCB concentrations. Bank and sediment edge excavation would be performed similarly to the Area 3 TCRA work, with restored banks, erosion controls, and riparian restoration. The excavation zone within 50 feet of the channel would not be backfilled, but 6 inches of topsoil would be placed to support vegetation and habitat restoration. Where the excavated zone is upland of a previously restored TCRA bank, drainage swales would be constructed to communicate drainage from the new low-lying area to the river. A drainage swale would also be provided on the northwest side of the main cap area to allow drainage back to the river between the north side of the cap and the study area boundary.

Alternative 3 includes approximately 15.8 acres of capping and 8,300 cy of floodplain soil excavation (2.3 acres) downstream of the M-89 Bridge, plus 11,300 cy of bank soil/edge sediment excavation along 6,600 feet of the Area 3 channel upstream of the M-89 Bridge. The total remedial footprint comprises approximately 22.1 acres.

The time to reach protective levels and compliance with PRGs under Alternative 3 is estimated to be a minimum of 33 years after ROD issuance.

Estimated Capital Cost: $28,400,000
Estimated Annual O&M Cost: $84,600
Estimated Total Present Worth Cost: $28,700,000
Estimated Construction Timeframe: 2 years

Alternative 4: Excavation and backfill of floodplain soil exceeding RAL-20 outside of TCRA areas, targeted excavation, upstream bank soil/sediment edge excavation with bank protection and restoration ECs, Pine Creek MNR, ICs, capping and/or ICs or excavation for private recreational parcels, and LTM
(THIS IS EPA'S RECOMMENDED ALTERNATIVE)

Alternative 4 is the same as Alternative 2, except that the floodplain soil areas exceeding the PCB RAL of 20 mg/kg would be excavated instead of capped. The components of Alternative 4 are discussed in detail below and shown on Figure 9. In summary, Alternative 4 includes:

- No further action in the completed TCRA areas;
- RD sampling as approved by EPA;
- Excavation and backfill of floodplain soil exceeding RAL-20 outside of TCRA areas;
- Targeted media excavation exceeding 50 mg/kg PCBs;
- Upstream bank soil/sediment edge excavation, with bank protection and restoration ECs (as discussed above in the *Common Elements* section);
- Transportation of excavated contaminated media to appropriate, approved landfills for off-site disposal;
- Pine Creek MNR (as discussed above in the *Common Elements* section);

- ICs to advise against fish consumption;
- Capping and/or ICs or excavation for private recreational parcels with floodplain soil exceeding 2.5 mg/kg PCBs (as discussed above in the *Common Elements* section); and
- LTM and maintenance including area-wide monitoring, inspection, and maintenance of bank erosion controls and capped areas (if any) (as discussed above in the *Common Elements* section).

The excavation zone within 50 feet of the channel would not be backfilled, but 6 inches of topsoil would be placed to support vegetation and habitat restoration. The remainder of the excavated area would be backfilled with 1.5 feet of common fill and 6 inches of topsoil and restored as riparian habitat.

Alternative 4 includes approximately 58,500 cy of floodplain soil excavation (18.1 acres) downstream of the M-89 Bridge, and 11,300 cy of bank soil/edge sediment excavation along 6,600 feet of the Area 3 channel upstream of the M-89 Bridge. The total remedial footprint comprises approximately 22.1 acres.

The time to reach protective levels and compliance with PRGs under Alternative 4 is estimated to be a minimum of 33 years after ROD issuance.

Estimated Capital Cost: $33,500,000
Estimated Annual O&M Cost: $61,500
Estimated Total Present Worth Cost: $33,400,000
Estimated Construction Timeframe: 2 years

Alternative 5: Aggressive excavation and backfill of areas exceeding a RAL of 0.33 mg/kg for floodplain and bank soil outside of TCRA areas, Pine Creek Impoundment excavation, channel sediment edge excavation, restoration of bank/upland excavated areas, and LTM

The components of Alternative 5 are discussed in detail below and shown on Figure 10. In summary, Alternative 5 includes:

- Area 3-wide excavation of floodplain soil and channel edge sediment with PCB concentrations exceeding a RAL of 0.33 mg/kg and restoration of floodplain areas as riparian habitat;
- Excavation of Pine Creek Impoundment sediment within the Area 3 study area boundary;
- Transportation of excavated contaminated media to appropriate, approved landfills for off-site disposal;
- Access agreements including rental and/or purchase of property;
- ICs (fish consumption advisories and signage); and
- LTM.

An area-wide excavation alternative is evaluated to provide the full range of potential remedial options for the Site. Alternative 5 includes an area-wide excavation of floodplain soil and channel edge sediment exceeding 0.33 mg/kg PCBs. Selection of a PRG of 0.33 mg/kg is consistent with that selected for evaluation in the Area 1 FS and the Area 2 FS and represents the sediment PRG. In this case, the river would be allowed to freely migrate in the future to any point in the floodplain and meet the sediment PRG (i.e., no bank erosion control ECs would be necessary). Excavation areas would be backfilled to pre-excavation grade and vegetated (restored as riparian habitat). The area-wide excavation would also include excavation of the Pine Creek Impoundment sediments within the study area boundary. An overall LTM program would be implemented to monitor, confirm, and document the decline of PCB concentrations in Site media in Area 3 following remedy implementation. The LTM program would include inspection of bank treatments and riparian restoration areas (including previously restored TCRA areas not further excavated). The LTM sampling program would support post-remedy five-year reviews and would include collection of sediment, soil, surface water, and fish tissue samples.

Alternative 5 includes the excavation of 522,000 cy spanning 149 acres. Floodplain volume and area comprise 427,000 cy and 120 acres, respectively, which are the quantities required to remove soil to the deepest interpolated value exceeding 0.33 mg/kg. The excavation zone within 50 feet of the channel would not be backfilled, but 6 inches of topsoil would be placed to support vegetation and habitat restoration. The remainder of the excavated areas would be backfilled with common fill and 6 inches of topsoil to restore original grade and provide support for riparian vegetation restoration. Alternative 5 also includes the excavation of 94,300 cy of sediment to an assumed depth of 2 feet over 29.2 acres of the Pine Creek Impoundment within the Area 3 study area boundary.

The aggressive excavation work would mean invasive floodplain-wide impacts to habitat. Habitat and wildlife recovery times could be lengthy, and the potential of invasive species to propagate may impact full recovery.

Alternative 5 would reach PRGs for smallmouth bass within an estimated 36 years after ROD issuance.

Estimated Capital Cost: $ 131,000,000
Estimated Annual O&M Cost: $54,350
Estimated Total Present Worth Cost: $116,000,000
Estimated Construction Timeframe: 5 years

8. EVALUATION OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives. The purpose of this evaluation is to promote consistent identification of the relative advantages and disadvantages of each alternative, thereby guiding selection of remedies offering the most effective and efficient means of achieving site cleanup goals. While all nine criteria are important, they are weighed differently in the decision-making process depending on whether

they evaluate protection of human health and the environment or compliance with federal and state ARARs (threshold criteria), consider technical or economic merits (primary balancing criteria), or involve the evaluation of non-EPA reviewers that may influence an EPA decision (modifying criteria). These nine criteria are described below, followed by a discussion of how each alternative meets or does not meet each criterion.

Explanation of the Nine Evaluation Criteria

Threshold Criteria

1. ***Overall Protection of Human Health and the Environment*** addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed by the site are eliminated, reduced or controlled through treatment, engineering, or institutional controls.

2. ***Compliance with Applicable or Relevant and Appropriate Requirements*** addresses whether a remedy will meet the applicable or relevant and appropriate federal and state requirements, known as ARARs.

Primary Balancing Criteria

3. ***Long-Term Effectiveness and Permanence*** refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met.

4. ***Reduction of Toxicity, Mobility, or Volume Through Treatment*** addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at the site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

5. ***Short-Term Effectiveness*** addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction of the remedy until cleanup levels are achieved. This criterion also considers the effectiveness of mitigative measures and time until protection is achieved through attainment of the RAOs.

6. ***Implementability*** addresses the technical and administrative feasibility of a remedy from design through construction, including the availability of services and materials needed to implement a particular option and coordination with other governmental entities.

7. ***Cost*** includes estimated capital costs, annual O&M costs, and the total present worth of the capital and O&M costs, including long-term monitoring. The total present worth cost is calculated using a discount rate that takes into account the time value of money.

Modifying Criteria

8. ***State Agency Acceptance*** considers whether the state support agency supports the preferred alternative presented in the Proposed Plan and concurs with the selected remedy.

9. ***Community Acceptance*** addresses the public's general response to the remedial alternatives and the preferred alternative presented in the Proposed Plan.

Comparison of Alternatives

Each of the nine evaluation criteria are discussed below with respect to the alternatives under consideration for this remedial action. In addition, Table 1 provides a qualitative summary of how the cleanup alternatives compare against the first seven criteria; the remaining two criteria will be evaluated following the public comment period for the Proposed Plan. More details regarding the evaluation and comparison of the cleanup alternatives against the nine criteria can be found in the Area 3 FS Report.

Overall Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment. This alternative would not improve, reduce, or control risk to human health or ecological receptors beyond that initiated by the TCRA to date. Although sediment PRGs might be met in 34 years, no monitoring would occur with Alternative 1, so any recovery rates and the achievement of protective levels would not be documented. Alternative 1 would not address RAOs 3, 4 or 5, as it would not address contaminated floodplain soils and would not reduce the transport of PCBs from Area 3 to downstream areas of the Kalamazoo River and Lake Michigan.

Alternatives 2 through 5 are protective of human health and the environment and would achieve PRGs. These alternatives would reduce floodplain exposure and would stabilize and restore river-bank areas upstream of the M-89 Bridge, eliminating these areas as sources of PCB contamination to fish as well as preventing the downstream migration of PCBs. Alternative 2 would use capping to address contaminated floodplain areas outside the TCRA footprint while Alternative 3 would use a combination of capping and excavation for those areas. Alternatives 4 and 5 would excavate contaminated floodplain soil outside the TCRA footprint, which would remove any possibility of PCBs from these areas entering the river system. Under Alternative 5, aggressive excavation would be performed throughout Area 3 to remove both sediment and soil with PCB concentrations exceeding 0.33 mg/kg, thereby addressing a remedial footprint more than six times larger than Alternatives 2 through 4 (i.e., 149 acres vs. 22.1 acres). Alternative 5 would take more than twice as long to implement as Alternatives 2 through 4, and would result in extensive, invasive impacts to habitat throughout Area 3.

Alternatives 2 through 4 all would be expected to achieve the PRGs in 33 years, while Alternative 5 would be expected to achieve the PRGs in 36 years. The time to achieve PRGs for all alternatives are estimates based upon existing trends in fish tissue data, and assumptions used

from both previous sediment cleanups and the effectiveness of the TCRA. EPA will require LTM to continue until PRGs are achieved.

Compliance with ARARs

Alternative 1 might eventually meet most sediment chemical-specific ARARs through natural recovery, but would not meet chemical-specific ARARs for floodplain soils. Since no monitoring would be conducted under Alternative 1, compliance with the sediment ARARs under that alternative would not be confirmed or documented.

Alternatives 2 through 5 would meet ARARs through various methods (depending on the alternative; see description of alternatives in Section 7 above), including the following: excavating floodplain soil; installing protective barriers (soil caps) to prevent exposure to floodplain soil; conducting targeted excavation of certain areas containing PCB-contaminated material exceeding 50 mg/kg; conducting additional upstream bank/edge sediment removal; conducting environmental monitoring during implementation of the remedy; and using ICs (fish advisories, signage, and land use covenants) that would continue post-remedy. Compliance with ARARs would be demonstrated through LTM. Appropriate control measures would be implemented during construction such that the substantive requirements of the action- and location-specific ARARs would be achieved.

Long-term Effectiveness and Permanence

Alternative 1 would not provide for tracking or confirmation of future achievement of sediment RAOs, so long-term effectiveness would not be demonstrated or documented. Alternative 1 is not expected to achieve RAOs for floodplain soils.

Alternatives 2 through 4 would be effective in the long term and permanent, and would have a relatively comparable degree of long-term effectiveness and permanence. All of these alternatives include bank soil/sediment edge excavation with bank protection upstream of the M-89 Bridge. Alternatives 2 and 3 include capping at least some portion of the floodplain soil outside the TCRA areas (Alternative 3 includes capping only in locations more than 50 feet away from the channel while Alternative 2 would use a greater degree of capping), which would prevent contact by receptors and prevent erosion of floodplain soil, sediment, and bank soil. Alternatives 3 and 4 include excavating at least some portion of the floodplain soil outside of the TCRA areas (Alternative 3 includes excavation only in locations within 50 feet of the channel while Alternative 4 would use more extensive excavation) and transporting the excavated materials off-site for disposal, which would remove this PCB contamination from Area 3. Compared to Alternatives 2 and 3, Alternative 4 would provide a greater degree of long-term effectiveness and permanence because it would excavate floodplain soils and not cap any of the floodplain areas. Alternative 4 would therefore require less long-term maintenance than Alternatives 2 and 3. Alternatives 2 through 4 would achieve fish tissue PRGs for smallmouth bass within 33 years. LTM and ICs would remain in place until fish tissue PRGs are achieved.

Alternative 5 would have a high degree of long-term effectiveness and permanence, as all sediment and floodplain soil exceeding 0.33 mg/kg total PCBs would be removed. The time to

achieve the fish tissue PRGs for smallmouth bass is slightly longer for Alternative 5 than the other alternatives, estimated at 36 years, due to the longer construction timeframe. However, short-term and long-term impacts to habitat would be substantial and may outweigh the benefits of PCB removal.

Reduction of Toxicity, Mobility, or Volume through Treatment

None of the alternatives employ treatment technologies to reduce the toxicity, mobility or volume of the contaminated materials. However, Alternatives 3 through 5 would remove significant volumes of PCB-contaminated soil from Area 3, thereby reducing exposure to PCB contaminated soil and the ability of the PCB-contaminated soil to be mobilized into the river in the future. Due to the nature of the contamination, the PCB-contaminated sediment and soil does not lend itself to cost-effective treatment.

Short-term Effectiveness

Alternative 1 would have no adverse short-term impacts, as no active construction work is associated with this alternative. However, the time to achieve RAOs is also considered as part of the short-term effectiveness criterion, and this alternative would not achieve all of the RAOs. For this reason, Alternatives 1 is not considered effective in the short term.

Alternatives 2 through 4 would have the same relative degree of short-term effectiveness. Floodplain capping and/or excavation along with bank soil/sediment edge excavation with bank protection would prevent contact to receptors immediately upon remedy completion. Temporary, reversible, and limited impact would occur to habitat areas where the cap is applied or soil is excavated, and in support areas such as staging areas and constructed access roads. These impacts would be addressed by revegetating the disturbed areas to initiate habitat recovery. Risks to workers during construction activities would be controlled through safe work practices and training. The implementation period for Alternatives 2 through 4 would be approximately 2 years.

Alternative 5 would have the greatest degree of short-term impacts because of the longer construction period, estimated at 5 years, and the extensive excavation work throughout Area 3. Compared to the other alternatives, Alternative 5 requires extensive and invasive floodplain-wide excavation and habitat impact. Risks to workers during construction activities would be controlled through safe work practices and training.

Implementability

Alternative 1 could be easily implemented. No active measures are associated with Alternative 1.

Alternatives 2 through 4 are all readily implementable and would be performed using conventional, readily available equipment and practices. The remediation activities, which include capping and/or excavation work and restoration of disturbed areas, would be conducted over an estimated period of two years and would require the construction of access roads and staging areas, as well as access agreements with property owners. Although CERCLA sites are

not subject to the permit approval process, remedial actions must meet the substantive requirements of otherwise applicable permits for capping in the floodplain. Dewatered, excavated material would need to be transported to approved landfills for disposal, and adequate landfill capacity is available.

Alternative 3 would be slightly more difficult to implement than Alternative 2, as floodplain soils exceeding the 20 mg/kg PCB RAL within 50 feet of the river channel would be excavated rather than capped. This would increase the volume of material requiring dewatering, transport and disposal.

Alternative 4 would be slightly more difficult to implement than Alternatives 2 and 3, as all floodplain soils exceeding the 20 mg/kg PCB RAL would be excavated. This would increase the volume of material requiring dewatering, transport and disposal.

Alternative 5 would be the most difficult to implement. This alternative requires an extensive network of access roads and staging areas as well as a significant volume of material requiring dewatering, transport, and disposal. A significant volume of borrow or imported material would be required for backfill. Negotiations with private parcel owners would be more intensive due to the extent and invasive nature of the remediation. It is possible that rental or purchase of properties may be required to gain access and implement this alternative. Work would be performed using conventional, readily available equipment and practices, but the implementation time would be longer than the other alternatives, estimated at approximately 5 years. Additionally, parcel owners may be unwilling to allow substantial disruption to (potentially perceived as destruction of) their property.

Cost

The estimated total present worth costs for each alternative are FS-level cost estimates that have an expected accuracy of +50% to -30%. The total present worth costs for the alternatives range from zero to $116 million, as listed below. A 7% discount factor was used to develop the cost estimates.

Alternative 1: $0
Alternative 2: $26,300,000
Alternative 3: $28,700,000
Alternative 4: $33,400,000
Alternative 5: $116,000,000

Alternative 5 is the highest cost alternative because 522,000 cy of sediment and soil would be removed throughout Area 3 over the course of five years and transported for off-site disposal. The estimated costs for Alternatives 2 through 4 are similar and are an order of magnitude lower than the cost for Alternative 5. The cost of Alternative 4 is slightly higher than Alternatives 2 and 3 since under Alternative 4 floodplain soils outside the TCRA area are excavated and transported for off-site disposal. Alternative 1 is the least costly alternative (zero cost) because no actions would be taken under that alternative.

The final cost estimate for the Selected Remedy will be developed and refined during the RD.

State Agency Acceptance

The State of Michigan's acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the ROD for Area 3 of OU5. Based on the Area 3 FS and review of the draft Proposed Plan, the State of Michigan supports EPA's proposal of Alternative 4 as the preferred alternative.

Community Acceptance

The local community's acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the ROD for Area 3 of OU5.

9. EPA's PREFERRED ALTERNATIVE

This section describes EPA's preferred alternative and explains the rationale for that preference. As noted earlier in this Proposed Plan, EPA has not identified any principal threat wastes at OU5 that need to be addressed.

EPA's Preferred Alternative – Alternative 4: Excavation and backfill of floodplain soil exceeding RAL-20 outside of TCRA areas, targeted excavation, upstream bank soil/ sediment edge excavation with bank protection and restoration ECs, Pine Creek MNR, ICs, capping and/or ICs or excavation for private recreational parcels, and LTM

Based on the evaluation of the various remedial alternatives summarized in Section 8, *Evaluation of Alternatives*, EPA believes that Alternative 4 is the most appropriate cleanup alternative for Area 3 of OU5.

The components of Alternative 4 are discussed in detail below and shown on Figure 9. In summary, Alternative 4 includes:

- No further action in the completed TCRA areas;
- RD sampling as approved by EPA;
- Excavation and backfill of floodplain soil exceeding RAL-20 outside of TCRA areas;
- Targeted media excavation exceeding 50 mg/kg PCBs;
- Upstream bank soil/sediment edge excavation, with bank protection and restoration ECs;
- Transportation of excavated contaminated media to appropriate, approved landfills for off-site disposal;
- Pine Creek MNR;
- ICs to advise against fish consumption;
- Capping and/or ICs or excavation for private recreational parcels with floodplain soil exceeding 2.5 mg/kg PCBs; and

- LTM and maintenance including area-wide monitoring, inspection, and maintenance of bank erosion controls and capped areas (if any).

Alternative 4 includes approximately 58,500 cy of floodplain soil excavation (18.1 acres) downstream of the M-89 Bridge, and 11,300 cy of bank soil/edge sediment along 6,600 feet of the Area 3 channel upstream of the M-89 Bridge. The total remedial footprint comprises approximately 22.1 acres.

The time to reach protective levels and compliance with PRGs under Alternative 4 is estimated to be a minimum of 33 years after ROD issuance.

The time to complete construction would be approximately 2 years, at an estimated total present worth cost of $33,400,000.

Alternative 4 includes the following main components:

1. **No further action in the completed TCRA areas**: The TCRA that was conducted from 2016 to 2018 within the downstream portion of Area 3 between the M-89 Bridge and the former Otsego Township Dam removed a total of 34,073 cubic yards of PCB-contaminated soil and sediment. Based on the confirmation sampling results, post-TCRA sediment SWACs, and removal quantities described earlier in this Proposed Plan, EPA proposes that no further remedial response action be taken in the TCRA portion of Area 3.

2. **RD sampling as approved by EPA:** Sampling would include the identification of the remedial area footprints, as well as targeting the SRI sample locations that exceeded 50 mg/kg PCBs to confirm the presence and extent of such hot spots for targeted removal. RD sampling would be conducted to determine whether any floodplain soils on privately-owned parcels exceed 2.5 mg/kg PCBs, and would be used to determine the location and extent of the bank/edge sediment areas that require remediation upstream of the M-89 Bridge, as described in the *Common Elements* discussion in Section 7, above.

3. **Excavation and backfill of floodplain soil exceeding RAL-20 outside of TCRA areas:** Excavation would be completed in floodplain areas outside the TCRA footprint where soil PCB concentrations exceed the proposed RAL of 20 mg/kg to prevent exposure to ecological receptors at a PRG of 11 mg/kg in the moving window evaluation. Using a RAL of 20 mg/kg as a trigger for action and meeting a PRG of 11 mg/kg would also be protective of recreational users, who would be protected by a PRG of 23 mg/kg. The excavation zone within 50 feet of the channel would not be backfilled, but 6 inches of topsoil would be placed to support vegetation and habitat restoration. The remainder of the excavated area would be backfilled with 1.5 feet of common fill and 6 inches of topsoil and restored as riparian habitat.

4. **Targeted media excavation exceeding 50 mg/kg PCBs:** Confirmed media exceeding 50 mg/kg PCBs would be excavated and backfilled. Any excavations within 50 feet of the channel would not be backfilled, but 6 inches of topsoil would be placed to support

vegetation and habitat restoration. The remainder of the excavated area would be backfilled with 1.5 feet of common fill and 6 inches of topsoil and restored as riparian habitat.

5. **Upstream bank soil/sediment edge excavation, with bank protection and restoration ECs:** Bank soil and edge sediment excavation would be performed upstream of the M-89 Bridge. The anticipated remedial footprint is subject to remedial design sampling, as noted above. Remedial action assumes excavation, bank toe stabilization, and bank restoration. These ECs would include elements such as robust bank treatments (e.g., wrapped earth with live stakes, buried rip rap/boulders, rootwads, and other vegetative cover), in-stream energy dissipation structures to reduce shear stress along the bank, and optimization of the channel depth/width. Where removal of soil along the bank face will occur, the cross-sectional length of removal will include the 10-foot buffer and will also depend on the bank treatment and design requirements for the restored bank slope. These treatments typically range in length from 3 to 7 feet and would be included within a 10-foot buffer provided as an additional safety factor. Banks opposite to those undergoing remedial excavation will be protected from excessive erosion during construction if the channel width is narrowed to accommodate construction activities. Transitions in bank treatment between bank areas that require remediation and those that do not require remediation are included in the conceptual design and costing.

6. **Transportation of excavated contaminated media to appropriate, approved landfills for off-site disposal:** All excavated contaminated soil and sediment will be handled, transported and disposed according to federal and state regulations. Disposal of contaminated soil and sediment will occur at permitted commercial facilities designed to handle such materials.

7. **Pine Creek MNR:** MNR for Pine Creek sediment is supported by fish tissue concentrations and risk calculations completed for fish ingestion in the Pine Creek Impoundment as described in the *Common Elements* discussion in Section 7, above. Risk associated with fish ingestion from this area is within an acceptable range for central tendency and high-end sport anglers, and is slightly above the acceptable range for subsistence anglers. The 2012 fish tissue sample results from Pine Creek indicated that all the largemouth bass fillet samples collected were ND for PCBs at a detection limit of 0.04 mg/kg and met the PRG for fish tissue of 0.042 mg/kg. The August 2020 fish tissue sample results for Pine Creek indicated PCB concentrations in fillets of adult bluegill, largemouth bass, and pumpkinseed were less than the fish tissue PRG. Adult carp were the only fish species that exceeded the PRG with PCB concentrations ranging from 0.046 to 0.36 mg/kg. In addition, the 2020 sampling included the collection of 92 sediment samples from Pine Creek with the SWAC at the surface interval (0–6 inches) having a mean of 0.3 mg/kg and a 95% UCL of 0.4 mg/kg, which is within the range of the sediment PRG of 0.33 mg/kg. (Both spatial interpolations and subsequent arithmetic averages and ULC95s, and the aspatial arithmetic average and UCL95, yielded similar results.) The 2020 sediment and fish data collection provided consistent results with previous data, supporting MNR. Pine Creek MNR requires additional sediment and fish tissue sampling to confirm sediment and fish tissue PRGs have been attained or are decreasing. Should future data indicate sediment and fish are above PRGs, additional remedial action may be required.

8. **ICs to advise against fish consumption:** Site-specific fish consumption advisories established and publicized by the State of Michigan would continue to manage risks posed to anglers and their families from consumption of PCB-containing fish. These advisories, which include warning signage posted along the river, are already in place for Area 3, and the advisory for each fish type would remain in effect until fish tissue PCB concentrations achieve RAOs for the fish specified. The advisories would be reviewed and verified annually as a component of the site ICs.

9. **Capping and/or ICs or excavation for private recreational parcels with floodplain soil exceeding 2.5 mg/kg PCBs:** Two privately-owned parcels that are currently used recreationally were identified in the floodplain downstream of the M-89 Bridge. Depending on RD sampling results, these properties may be candidates for excavation, capping, and/or a deed restriction providing for recreational-use-only future use scenarios, as described in the *Common Elements* discussion in Section 7, above. The ICs for any capped areas would also need to prevent disturbance of the caps to ensure the integrity of the constructed remedy components. Several parcels upstream of the M-89 Bridge were sampled using an incremental sampling method; sample results were less than 2.5 mg/kg and do not indicate an unacceptable risk at residential parcels. In addition to the private parcels in Area 3, there are industrial-zoned and recreational parcels for which ICs may be required.

10. **LTM and maintenance including area-wide monitoring, inspection, and maintenance of bank erosion controls and capped areas (if any):** An overall LTM program as described in the *Common Elements* discussion in Section 7, above, would be implemented to monitor, confirm, and document the decline of PCB concentrations in Site media in Area 3 following remedy implementation, and document MNR in Pine Creek. The LTM program would include inspection and maintenance of bank treatments and riparian restoration completed under both the remedial action and the Area 3 TCRA, inspection and maintenance of capped floodplain areas (if any), and verification that the ICs implemented as part of the remedy remain in place. Fish tissue and sediment sampling would be performed to (1) confirm that sediment concentrations throughout Area 3 have attained the sediment PRG of 0.33 mg/kg; (2) evaluate MNR conditions in the Pine Creek Impoundment relative to meeting the sediment PRG of 0.33 mg/kg over time; and (3) document that fish tissue concentrations have attained PRGs or are decreasing. Additional remediation would be considered if remedial design data do not support MNR in Pine Creek. The LTM sampling program would support post-remedy five-year reviews and would include collection of sediment, soil, surface water, and fish tissue samples until all PRGs are achieved and EPA approves the discontinuation of LTM in Area 3. Should remedial design and LTM indicate that fish tissue concentrations are increasing and exceed fish tissue PRGs, then an active remedy and remedial footprint for Pine Creek Impoundment within the study boundary would be evaluated.

Summary of Rationale for the Preferred Alternative

EPA believes that Alternative 4 provides the best balance of the evaluation criteria among all the alternatives. Alternative 4 would be protective of human health and the environment, would meet

all federal and state ARARs, would achieve the RAOs for this proposed remedial action, would be straightforward in its implementation, and would be effective in the long term and permanent.

Alternative 4 would provide long-term and permanent protection against exposure to contaminated materials by excavating approximately 58,500 cy (18.1 acres) of contaminated floodplain soil outside the TCRA footprint downstream of the M-89 Bridge, and 11,300 cy of bank soil/edge sediment along 6,600 feet of the Area 3 channel upstream of the M-89 Bridge. Remediating and stabilizing these areas will achieve RAO 4 (to reduce downstream PCB transport) and will lower the sediment SWAC to below the target sediment PRG. In turn, the reductions in aquatic PCB exposures are anticipated to reduce fish tissue PCB concentrations and achieve RAO 2 and the corresponding fish tissue PRGs over time. Additional sediment remediation beyond what is described above is not necessary because PRGs are anticipated to be achieved and the majority of elevated exposures are in the sediment bed adjacent to PCB-impacted banks. These remedial activities along with natural recovery processes, in conjunction with ICs and LTM, would ensure the PRGs and RAOs are achieved over time.

Alternative 4 would be effective in the short term, as it would prevent contact to floodplain receptors and result in stable river banks upstream of the M-89 Bridge immediately upon completion. Although Alternative 4 requires more material to be excavated and transported off-site for disposal than Alternatives 2 and 3, any associated short-term risks to workers and the local community during implementation could be easily managed and mitigated. Alternative 4 would be administratively and technically implementable and could be completed within 2 years.

Alternative 4 would protect human health and the environment at significantly less cost than Alternative 5 without extensive negative impact on habitat. Alternative 4 would achieve PRGs for smallmouth bass within 33 years, which is the same timeframe as Alternatives 2 and 3 but three years sooner than Alternative 5. Alternative 4 is slightly more expensive but comparable in cost to Alternatives 2 and 3, but requires less maintenance and LTM since the PCB-contaminated floodplain soil would be excavated and removed from Area 3 and no capping would be required (although there is a possibility of minimal capping on private parcels). Alternative 4 would not decrease flood capacity and would ensure connectivity between the floodplain and river within Area 3.

Alternative 4 would not reduce the toxicity, mobility or volume of the contamination through treatment, as the relatively low-level PCB contamination that is present in Area 3 of OU5 does not lend itself to any cost-effective treatment.

Summary

Based on the information currently available, EPA believes the preferred alternative identified above meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. EPA expects the preferred alternative to satisfy the following statutory requirements of CERCLA Section 121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery

technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

There have already been three Site-wide five-year reviews completed for the Allied Paper, Inc./Portage Creek/Kalamazoo River Site. Since it will be several decades before fish tissue concentrations attain PRGs, and since PCBs in floodplain soils will remain above levels that allow for unlimited use and unrestricted exposure (i.e., residential use), Area 3 of OU5 will be included in future Site-wide five-year reviews.

Next Steps

EPA, in consultation with EGLE, will evaluate public comments on the preferred cleanup alternative during the public comment period before selecting a final remedial alternative as the Area 3 remedy. Based on new information or public comments, EPA may modify its preferred alternative or choose another. As such, EPA encourages the public to review and comment on all of the cleanup alternatives.

EPA will respond in writing to all significant comments in a Responsiveness Summary which will be part of the ROD. EPA will announce the selected cleanup alternative in local newspaper advertisements and will place a copy of the ROD in the local information repositories and on EPA's website at www.epa.gov/superfund/allied-paper-kalamazoo.

Figure 1: Allied Paper, Inc./Portage Creek/Kalamazoo River Site

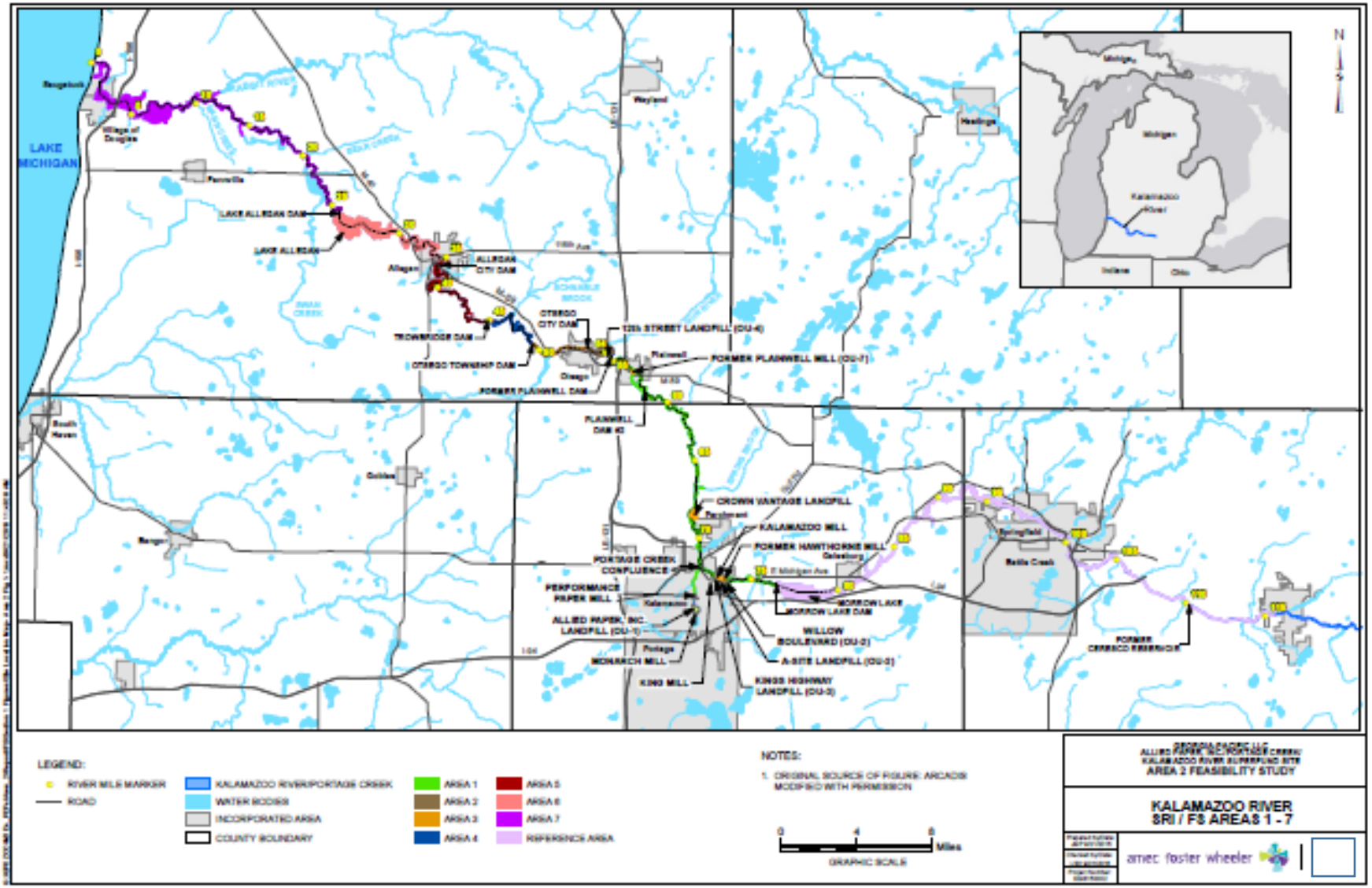

Figure 2: Operable Unit 5

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

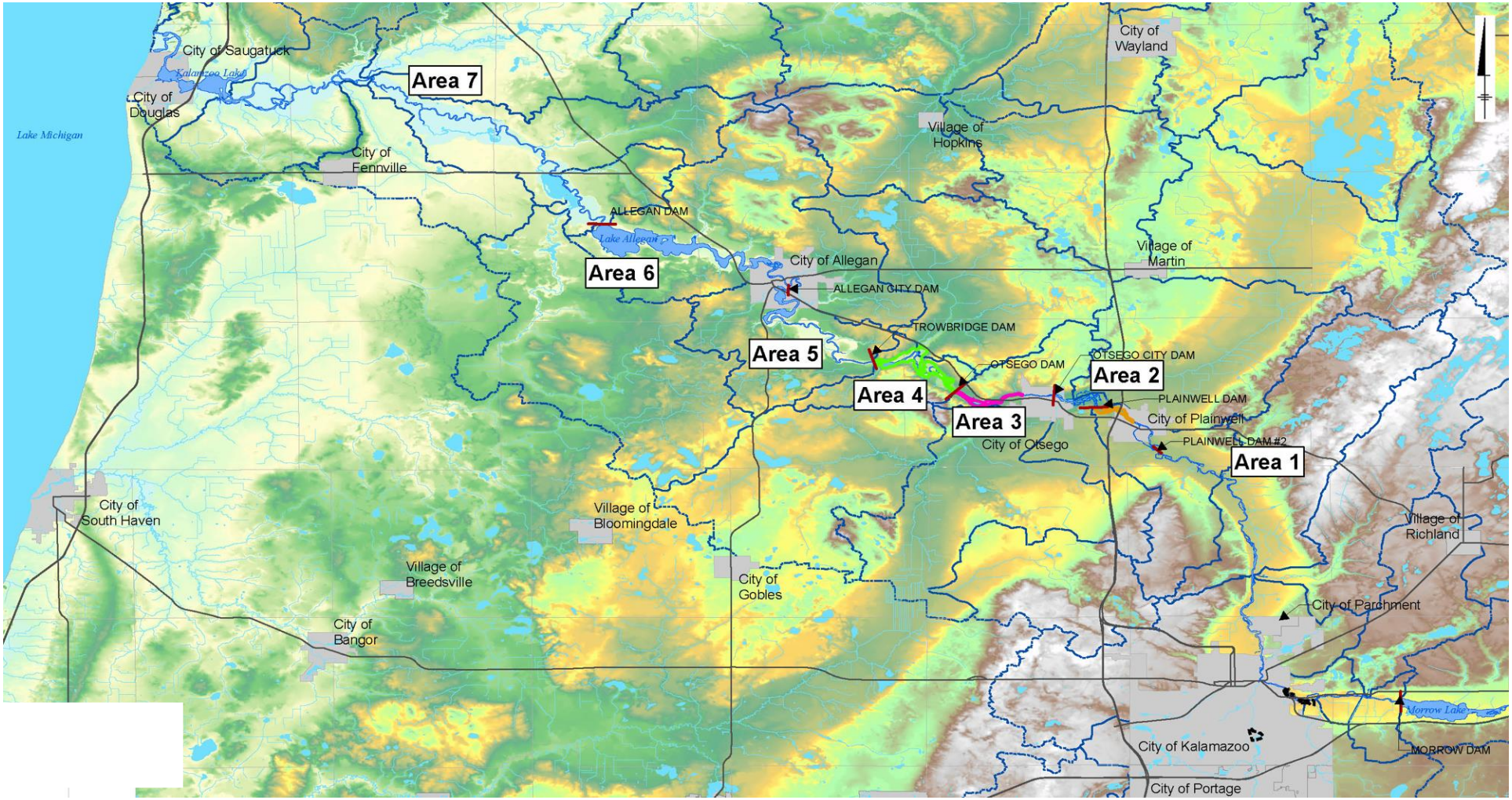

Figure 3: Area 3

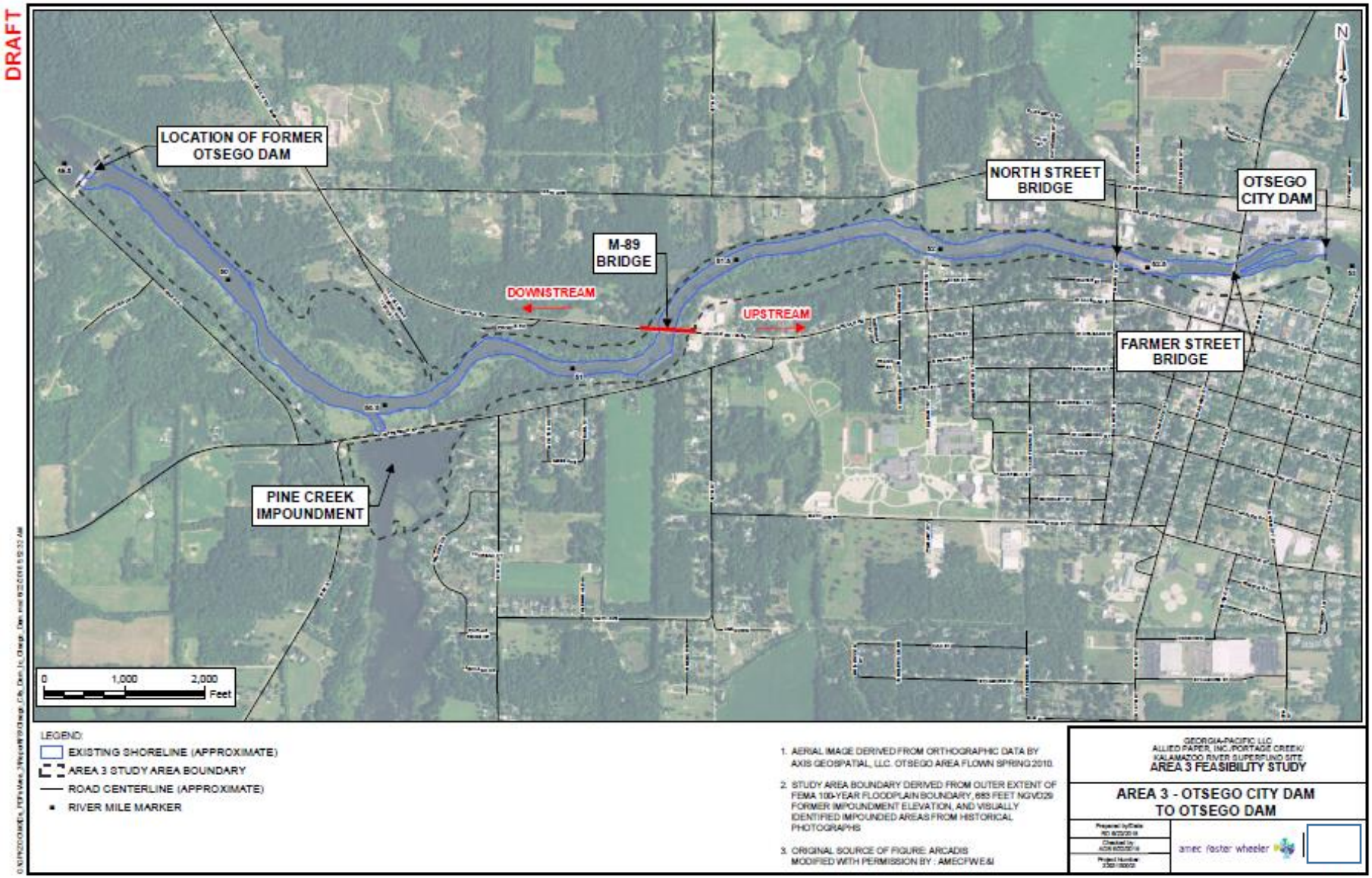

Figure 4: TCRA Area

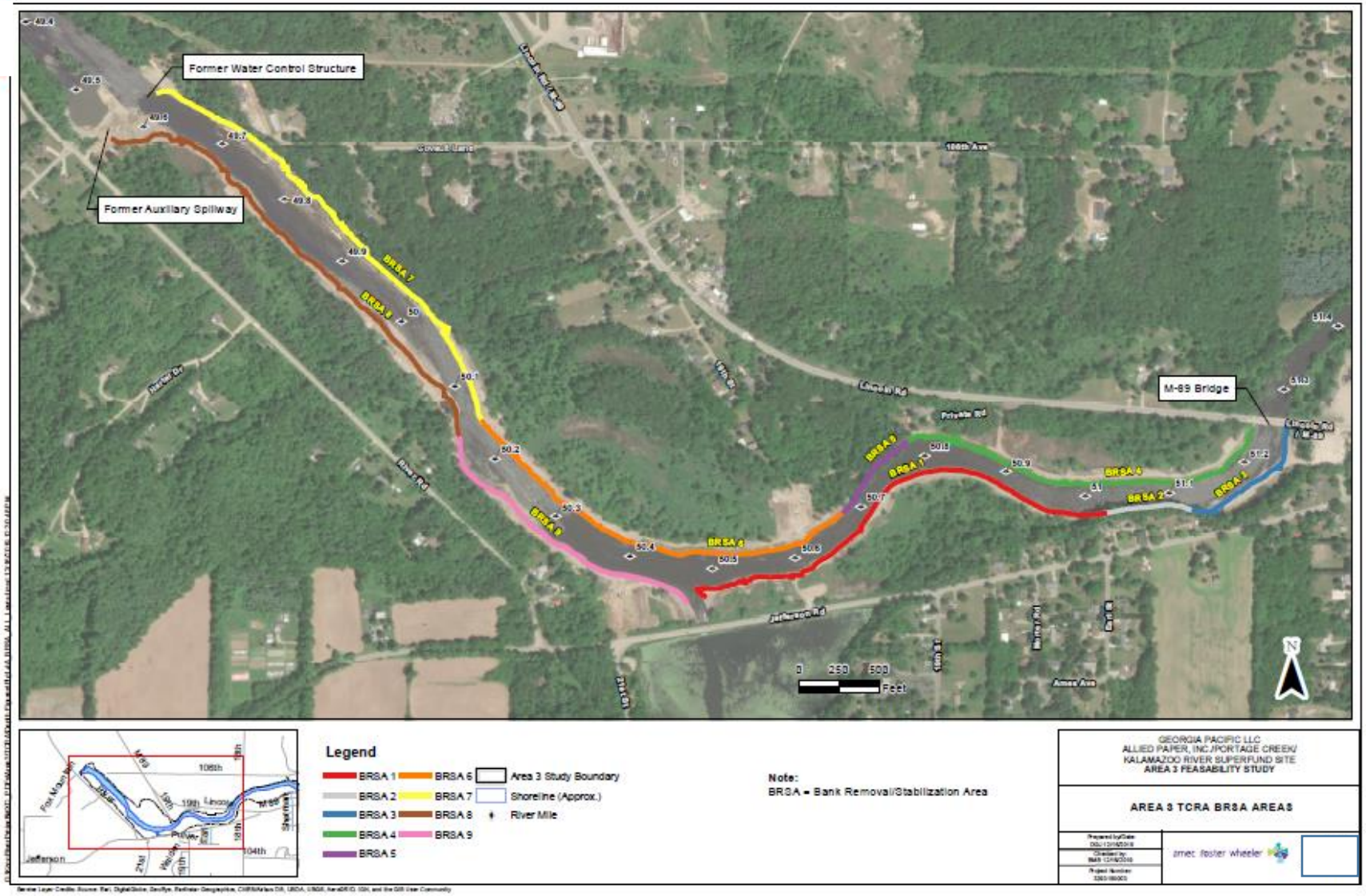

Figure 5: Remedial Area Outside of the TCRA

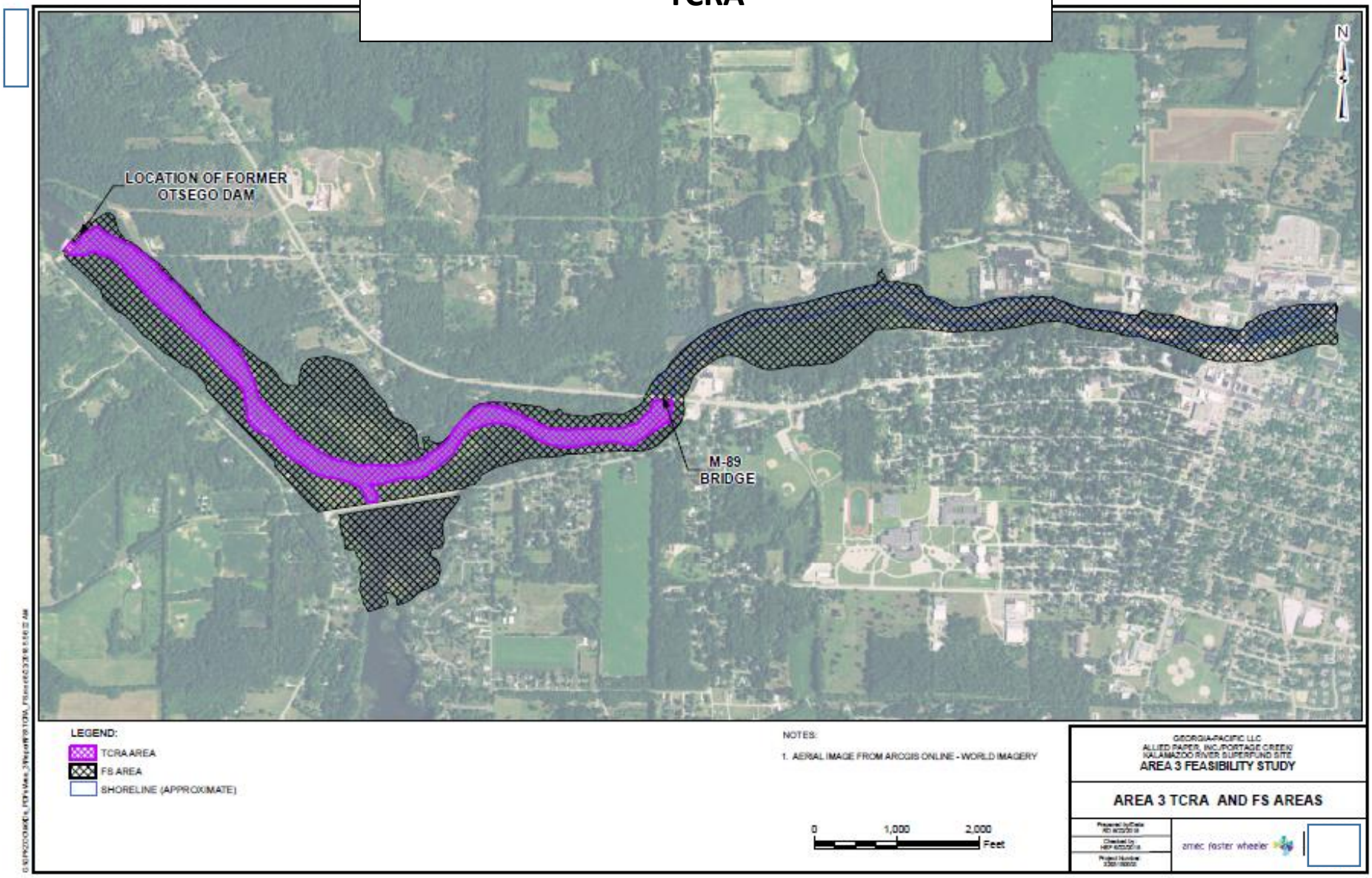

Figure 6: Bank Remediation Areas Upstream of M-89 for Alternatives 2, 3 and 4

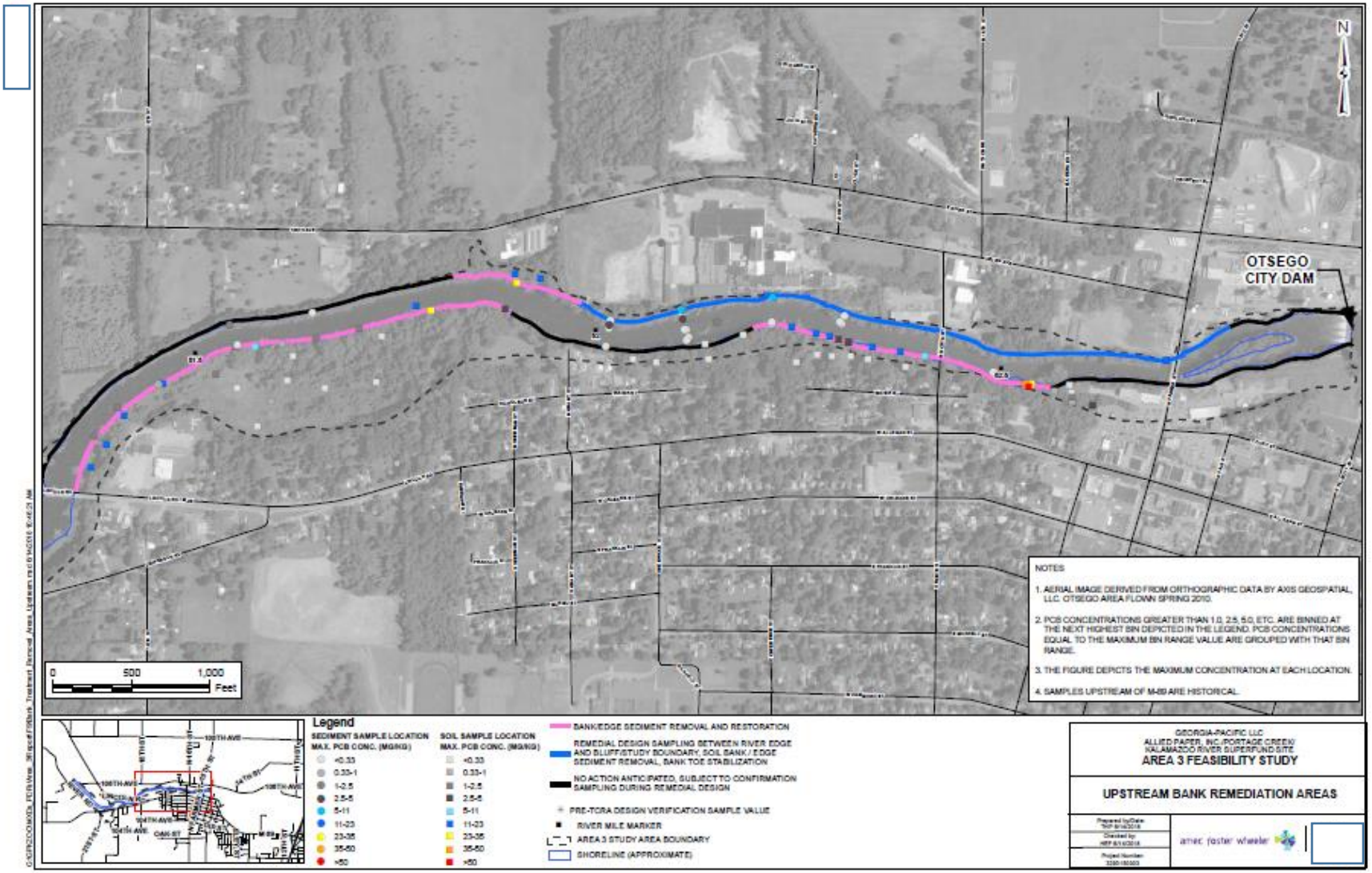

Figure 7: Alternative 2
Remedial Areas Outside of TCRA
Downstream of M-89 Bridge

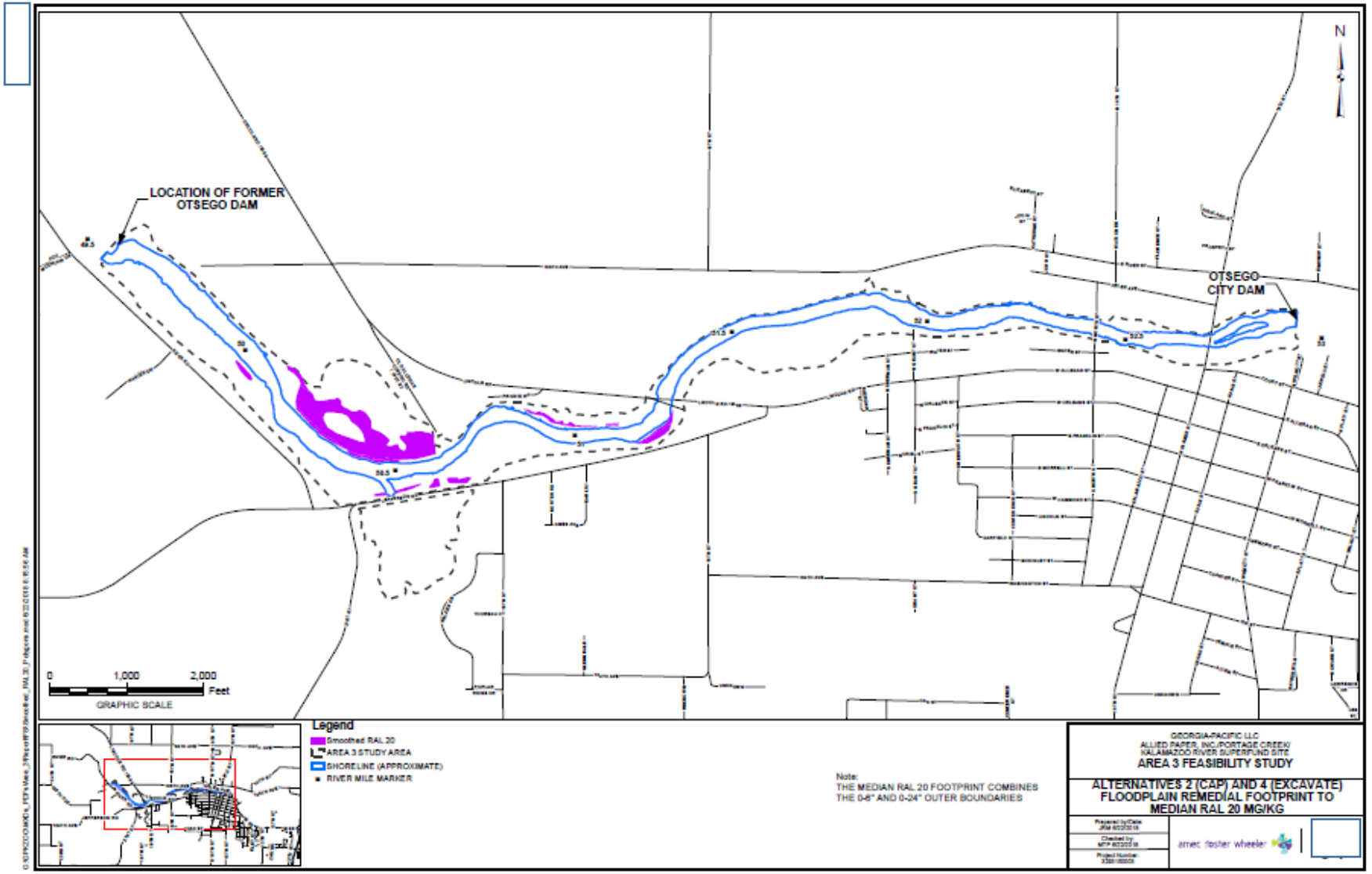

Figure 8: Alternative 3 Remedial Areas Outside of TCRA Downstream of M-89 Bridge

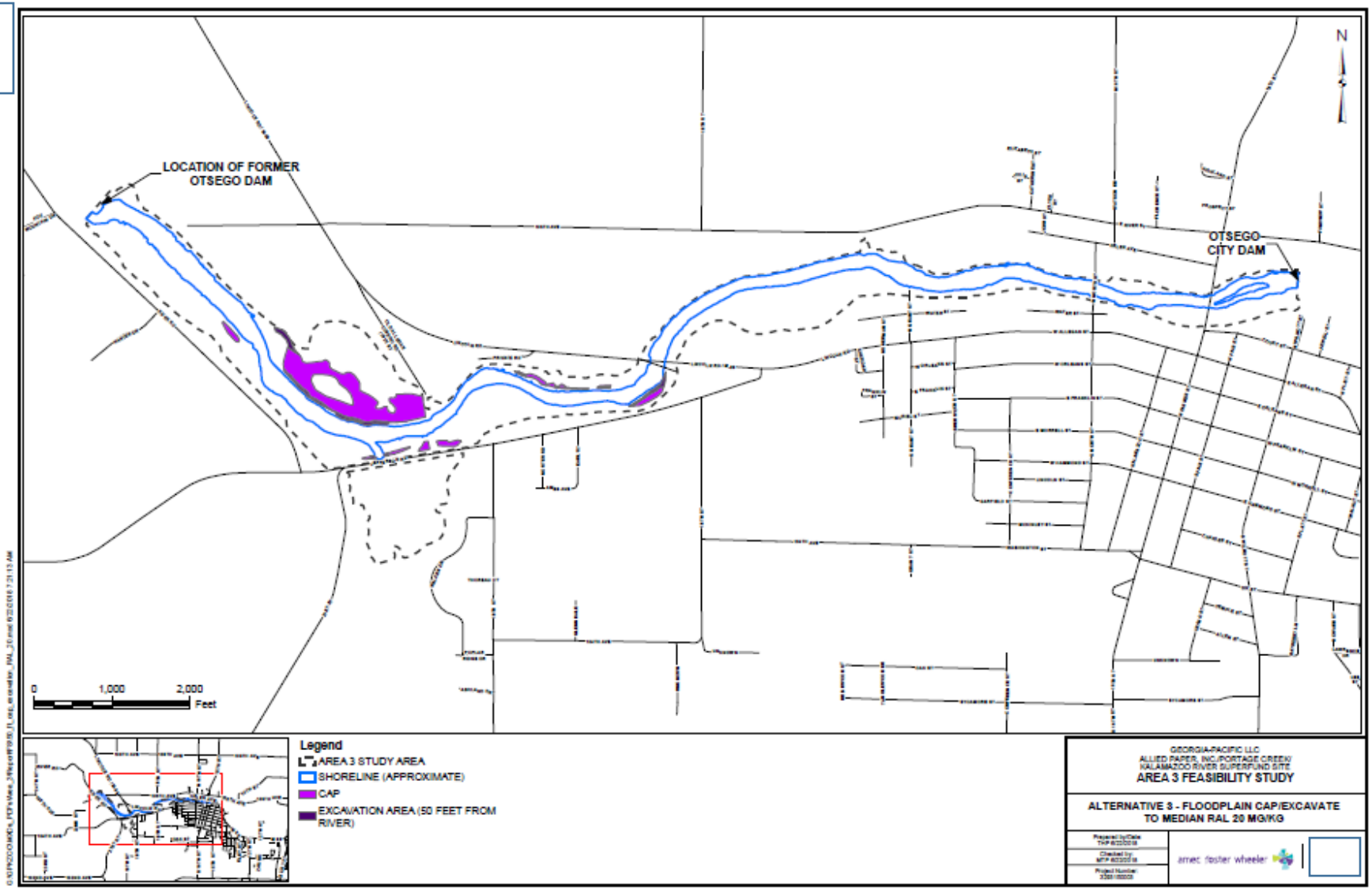

Figure 9: Alternative 4 Remedial Areas Outside of TCRA Downstream of M-89 Bridge

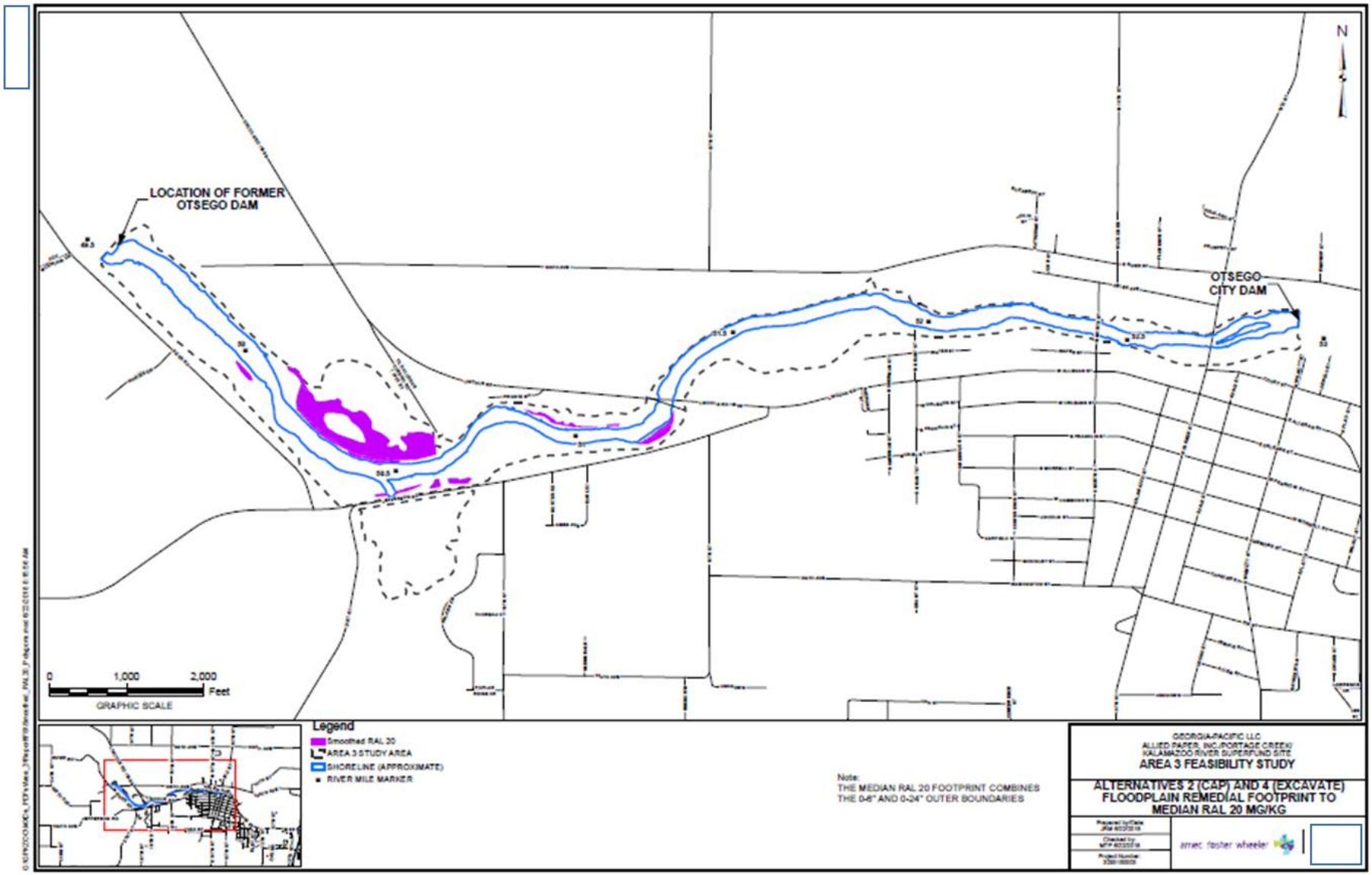

Figure 10: Alternative 5

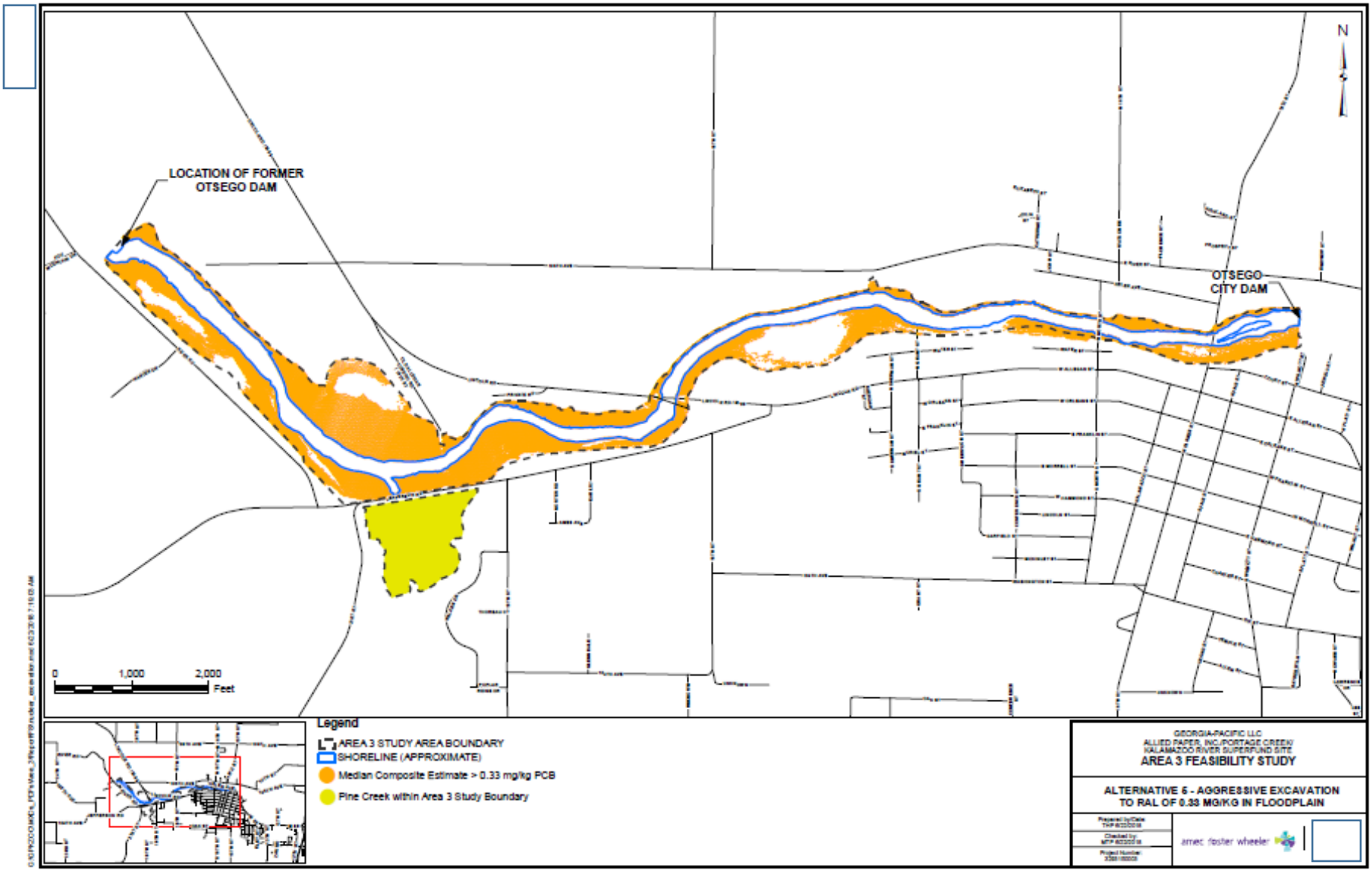

Table 1: Alternatives Comparative Analysis

Alternative	Capping Area (acres) / Removal Volume (cy)	Years to Reach PRGs for Smallmouth Bass	Overall Protection of Human Health and the Environment	Compliance with ARARs	Short-term Effectiveness	Long-term Effectiveness	Reduction of Toxicity, Mobility, and Volume Through Treatment	Implementability	Total Present Worth Cost
1: No Action	None	34	Undocumented	Undocumented	Not Effective	Undocumented	No treatment	Nothing to implement	$0
2: Capping of floodplain soil exceeding RAL-20 outside of TCRA areas, targeted excavation, upstream bank soil/sediment edge excavation with bank protection and restoration ECs, Pine Creek MNR, ICs, capping and/or ICs or excavation for private recreational parcels, and LTM	18.1 / 11,300	33	Protective, reasonable timeframe	Complies	Effective	Effective	No treatment	Readily implementable	$26,300,000
3: Combination of capping and excavation of floodplain soil exceeding RAL-20 outside of TCRA areas, targeted excavation, upstream bank soil/sediment edge excavation with bank protection and restoration ECs, Pine Creek MNR, ICs, capping and/or ICs or excavation for private recreational parcels, and LTM	15.8 / 20,100	33	Protective, reasonable timeframe	Complies	Effective	Effective	No treatment	Readily implementable	$28,700,000
4: Excavation and backfill of floodplain soil exceeding RAL-20 outside of TCRA areas, targeted excavation, upstream bank soil/sediment edge excavation with bank protection and restoration ECs, Pine Creek MNR, ICs, capping and/or ICs or excavation for private recreational parcels, and LTM	69,800	33	Protective, reasonable timeframe	Complies	Effective	Effective	No treatment	Readily implementable	$33,400,000
5: Aggressive excavation and backfill of areas exceeding a RAL of 0.33 mg/kg for floodplain and bank soil outside of TCRA areas, Pine Creek Impoundment excavation, channel sediment edge excavation, restoration of bank/upland excavated areas, and LTM	522,000	36	Protective, longer timeframe, extensive habitat destruction	Compliance delayed	Not Effective	Effective	No treatment	Requires Extensive effort	$116,000,000